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Autoclave Tests

AFTER two years of study of cements which did and did not pass the autoclave test, the Bureau of Standards has reported it as its conclusion that the high-pressure steam test is, for practical work under normal construction, of little value as a means of determining the ultimate soundness of the concrete. The conclusion, in full, will be found on page 655. Knowing the experience of the Germans with this test in the 80's, this conclusion was freely predicted almost two years ago. Nevertheless, the agitation connected with the attempt to introduce the test resulted in benefit to the industry by forcing it to study even more carefully than in the past the problems of grinding and aging.

Savings in Snow Removal

ANTAGONISM at first to a man who proposed to save New York City thousands of dollars annually in the cost of snow removal by introducing new methods in place of the old has gradually given way to real appreciation of work well done. No one who reads, on page 640 of this issue, Commissioner Fetherston's careful analysis of the results of last winter's campaign for keeping the streets open to traffic can fail to be impressed with the remarkable economies which the present system of handling the work has effected. With the "snow-fighting" force the rate of removal per day last winter increased approximately four times and the cost per cubic yard decreased about 75 per cent compared with the average results over a period of years. The results are a complete endorsement of Commissioner Fetherston's plan.

Another Anti-Trust Triumph

ONCE more the anti-trust laws have triumphed; the Interstate Commerce Commission has ordered the railroads to dispose of their steamship lines on the Great Lakes. There are some, it is true, who look at the matter from the selfish angle of benefit to the shipper, and would prefer not to tamper with a system that, as they testify, has been resulting in the best of service at the lowest rates in the world. They are even willing to let the railroads make a little money if the roads will continue to expedite the movement of their goods by swift, well-kept vessels and up-to-date machinery for trans-shipment at the docks. Fortunately these selfish interests have not been allowed to dominate the situation, and the small navigation company that has not the money, organization or energy to compete with the low rates and quick service of the railroad-owned boats will come into its own—that is, unless the shippers are so unreasonable as to send their goods all the way by rail rather than pay more money for less service by water.

Public Speaking Again

COMMENT has been made in this journal on the value to the engineer of facility in public speaking. There is no ground for dissent from the position taken, but often some striking incident is needed to carry full conviction. Evidently such was the case with a Western correspondent, who recently wrote this journal after attending a dinner at which two United States senators spoke. No comment is necessary on his letter. "I do not often go to hear politicians talk," he writes, "and after this experience do not think I will go again for a long time. Neither man impressed me as saying anything at all worth while. If engineers got up and gave as little information as these senators, supposedly leaders of the nation, they would be left off future programs of any engineering society. The lawyer and the politicians 'get away with it' because they can string words together, wave their arms and talk about the broad expanse of country from the rugged shore of Maine to the sunny climes of California. When engineers present good ideas but fail to clothe them in the best of terms they are looked upon as failures. Now, more than ever, I am convinced that the engineer should devote a lot of time to public speaking and to English. He has the ideas and all he needs to make himself appreciated is a little course in oratory."

The Question of Canals

AS NEW CANALS are being built at great cost in different parts of the country, old ones are succumbing to the lack of traffic. One of these unprofitable waterways is the Illinois & Michigan Canal, which was opened for traffic in 1848, is 96 miles long and cost $13,393,000. Its toll receipts in 1913, according to a report to the Legislature of the Illinois Efficiency and Economy Committee, were $2712, and the receipts from all sources $28,782, while its expenses were $49,103. There has been a fairly steady decline in tolls since 1865, when they reached a maximum of $300,810. The canal is being operated from the dwindling fund of the canal commissioners, the State is constitutionally prohibited from lending aid, and the locks and dams are so dilapidated, states the report, that they are likely to give way to unusual pressure. It will be protested that the decline in this canal's business is due to its failure to keep step with the times, and that the enlargement scheme now being agitated will restore the lost traffic. That is probably true, but there will be doubters until there has been more effective operation of scientifically designed barges on such waterways. On the other hand, the railroad has not reached its maximum effectiveness, while it has the decided advantage that improvements may be made in small sections, as needed. Canal improvement generally involves wholesale reconstruction. These are factors that must be considered, even though they are discouraging to canal development.

An Engineer Needed

IN THE REPORT mentioned in the preceding note it is stated that "the administration of the Illinois & Michigan Canal is largely an engineering problem and yet there is no engineer attached to the office in any way," and the report suggests that "this may perhaps help to explain why, although thousands of dollars are annually expended on canal maintenance and repairs, the general condition of the canal is constantly deteriorating." It seems difficult for the public to comprehend that the maintenance and operation of public works are engineering problems almost to the same degree as their design and construction. This journal has repeatedly deplored the practice of allowing costly highways, filter plants and the like to maintain and operate themselves. Canals are in the same class. It is apparent that it must be the constant endeavor of the profession to impress on the public that the engineer's functions are not confined to the figuring of stresses and the building of the structures, but embrace also the maintenance of the works and their operation.

Pile-Driving Specifications

A LETTER published in this issue emphasizes again dangers of ambiguous or incomplete contracts. In this case it appears that the contractor had agreed to drive piles to an indefinite depth, and to be paid for a length "per foot of pile in place." The party driving the piles, so it would appear from the letter, had further been told by the owner's engineer to buy a certain length of pile, and had been stopped by the same engineer from driving the full length of each pile below the grade from which the engineer claims the payment length is measured. A dispute followed. It hardly seems that after a pile has been driven to a point at which satisfactory bearing capacity is developed any contractor in his senses would want to drive it further, even at the lucrative price of 58 cents a foot. When a pile requires fifty blows to the inch from a steam hammer—and engineers often require driving past this limit—it takes 10 min. to drive the

pile 1 ft. To drive it 3 ft. would cost more than 58 cents in labor alone. Besides which, in the 30 min. thus lost, the same crew might have driven two or three entire piles, with a total penetration of many times 3 ft.

Perhaps the engineer in this case was not putting a heavy load on the piles, and stopped driving while the piles were still going easily. To do this, after taking the responsibility of requiring the contractor to buy longer piles than were needed, would certainly be unjust.

Probably the most common procedure is for the engineer to give the contractor the penetration required below cutoff, and let the latter take the responsibility of buying piles of the proper length. This is fair, as it gives the contractor a chance to figure into his price the material value of his wasted pile butts. Seldom do contractors succeed in driving piles without a waste of from 1 to 2 ft. per pile above cutoff.

It would seem, however, that contractors should expect some waste and figure it into the price. Moreover, when pile-driving contracts of good form are to be had in plenty, engineers certainly have no excuse for not specifying that the length to be paid for was the length driven below cutoff, if that were the intention.

Where the required length cannot be fully predetermined, or where piles of varying length are to be driven, the contractor is often allowed to bid a material price per foot for piles delivered, and another price per foot for piles driven below cutoff. If this had been done in the present case, probably the dispute would not have arisen.

Final Report on Philadelphia's Plan of Sewage Treatment

CONTAINING recommendations for work involving an expenditure of $34,600,000, to meet conditions in the year 1950, the final report of the Bureau of Surveys on the comprehensive plan for the collection, treatment and disposal of the sewage of Philadelphia was submitted to the City Council this week. The project is on such a large scale that it is possible at this time to give only a bare outline of its main features.

Sewage collected by the city's present system will be intercepted and conveyed by transverse collectors to three sites where treatment works will be installed—one on the Delaware River for the northern part of the city, one on the Delaware River, for the southeastern part, and the third at the mouth of the Schuylkill, for the central and western parts.

The first method of sewage treatment recommended at the northeast and southwest works involves coarse screens, grit chambers and two-story sedimentation tanks of the Imhoff type. As the volume of river water available for the assimilation of the effluent of the works remains practically the same, while the volume of sewage produced by the city steadily increases, due to growth in population, it may be necessary in the future to compensate for this increase in the amount of sewage by more refined treatment, which will probably consist in the oxidation of the tank effluent in percolating filters or by such other methods as may be approved at that time.

The treatment of the sewage carried to the southeast works will consist of coarse screens, grit chambers, and fine screens. The effluents of the proposed works will be disposed of by diffusion in the Delaware River through submerged outfalls, so located that the treated sewage will be rapidly distributed in the great tidal flow, thus utilizing to the fullest extent the oxidizing power of the river.

A definite program has been arranged for the expenditure of the funds on the proposed system. There is needed immediately an appropriation of $5,000,000 for the purchase of land at the sites of the three proposed treatment works, for the construction of collecting sewers, and for the construction of sewage-treatment works at the northeast site. These works will protect the Delaware River in the vicinity of the source of the city's water supply.

It is recommended that subsequent appropriations be made as rapidly as possible for the construction of the collecting sewers, pumping stations, treatment works and appurtenances generally in the order and for the works designated below:

For collecting sewer and treatment works for the sewage from the populous district of West Philadelphia, so as to abate in part the present pollution of the Schuylkill River, $5,700,000; for collecting sewers, pumping stations, extensions to the treatment works and appurtenances for practically all sewage tributary to the Schuylkill River from the city, $4,800,000—these works to restore and maintain the Schuylkill River in a clean condition; for collecting sewers which will intercept and convey to the northeast treatment works, without pumping, part of the sewage tributary to the Delaware River and for extensions to the treatment works, $3,400,000; for low-level collecting sewers along the Delaware River front from the northeast treatment works, with pumping stations and appurtenances, for the construction of the southeast clarification works, and the enlargement of the existing treatment works, $3,500,000.

These appropriations for construction, aggregating $22,400,000, will complete the system of collectors and provide for the treatment of all the dry-weather sewage and the first flush of rainfall. It is estimated that the operation and maintenance of these works will require annual appropriations of $500,000, in addition to which appropriations of at least $2,000,000 should be made each year for the construction of main and branch sewers to keep pace with the growth of the city.

The collecting sewers recommended are of a capacity ample for the year 1950, but before that time it will be requisite that the treatment of the sewage be carried to a greater degree of refinement. It is estimated that the extensions to the works to meet the conditions of the year 1950 will cost $12,200,000, thus making the total cost of the completed system $34,600,000.

It is also recommended that there be cooperation between the States of Pennsylvania and New Jersey so as to secure concordant action for the treatment of the sewage of communities in these States, which is discharged into the Delaware River or its tributaries.

The investigation involved a very large amount of careful and protracted study, involving not only experimental work at Philadelphia, but extensive travel in the United States and in Europe. Much credit is due those responsible for the work, George S. Webster, chief engineer of the Bureau of Surveys, George E. Datesman, principal assistant engineer, and W. L. Stevenson, assistant engineer.

National Waterworks Association Has Been Proposed

IN advocating a national waterworks association in his presidential address before the Cincinnati convention of the American Waterworks Association last week, George G. Earl raised an issue which has been discussed informally for some time past, but which has never before been placed squarely before the waterworks field for a decision. The plan provides, in effect, for the union of all the waterworks associations of America, with as many local branches and branch conventions and headquarters as can be maintained, but with one national annual convention and one publication which would contain all papers covering new matter of general interest.

To those who have followed the American association's recent activities in forming local sections in New York and in the Middle West, Mr. Earl's discussion does not come as a complete surprise. There has been a definite campaign for expansion and its logical outcome could only have been along the lines proposed at the Cincinnati convention. But while the movement has made rapid progress throughout the Middle West, and there is a probability of its extension to the Pacific Coast through the instrumentality of a California section, the real issue is in the East. Although no specific mention of the New England Waterworks Association was made by Mr. Earl, it is clear that upon the attitude of this body will depend the completeness of any project which can really be called national in its scope.

The situation with respect to the New England association is entirely different from any other which has been faced thus far, because the New England body, far from being a sectional organization, is national in everything but name. It has a large membership beyond the New England border and a roster which contains the names of many of the most distinguished members of the profession. It is on a sound basis financially, issues its own quarterly journal of proceedings and technical papers and can point to an unusual record of past usefulness, particularly with respect to its excellent committee reports, some of which embody undoubtedly the most complete treatment of special subjects ever undertaken. Particularly among its older members is the New England asso-

ciation dearly cherished, and any proposal for its conversion as a section of the American association would be regarded at first as nothing short of sacrilege. The case is analogous, in a way, to the plan advanced some years ago for the amalgamation of the Massachusetts Institute of Technology and Harvard, which met with strong opposition from a majority of the Institute's alumni. It is similar also to the present situation in the highway field, where two independent national bodies, the American Highway Association and the American Road Builders' Association, hold sway. Past efforts to bring these organizations together have been in vain, but at San Francisco this year they will unite in a Pan-American Road Congress. This move is significant.

Now that the issue of a single, country-wide association in the waterworks field has been raised, it is time for those whose interests are concerned to weigh carefully its merits and disadvantages. There is much to be said in favor of a single association. It would cut in half the time and expense of attending conventions. It would reduce the necessity of calling on busy men to prepare technical papers covering more or less the same ground for different associations. It would co-ordinate committee work. Certainly it is undesirable to have two different committees preparing standard specifications for, let us say, cast-iron pipe and specials, and it is still more undesirable for two such committees to submit different sets of "standards." It is true, of course, that certain committees of the American and New England associations, dealing with the same subjects, have co-operated in their work, but it is obvious that effort could be concentrated more effectively and time saved by one instead of two committees. Then, too, it is fair to assume that one large national organization would wield a stronger influence in moulding public opinion than would two smaller bodies. When State legislatures are enacting, or failing to enact, laws which affect such vital matters as stream pollution, the powers of State boards of health, purity of drinking water and protection of watersheds, and are leaving to the hands of unskilled and unqualified men the operation of costly filtration plants upon which the health of thousands depends, it is of first importance that statutes be based on sound engineering principles. There is a large opportunity for a national waterworks association to make its influence felt and to direct public opinion into proper channels.

The first thought which comes to mind when a national association is mentioned is that its size would destroy the intimate personal feature which has been one of the most valuable assets of the smaller organizations. It must be remembered, however, that the large body would be composed of sectional units, each holding its own meetings at regular intervals. These occasions would offer an adequate means for close contact among members.

As for the realization of a plan which will unite the American and New England associations, it is still too early to make predictions. Doubtless the matter will be an important part of next year's convention of the American association at New York, where it will be practicable for members of both bodies to be present in large numbers. There is no doubt that the two organizations are now closer together than ever before. The recent co-operation on committee work is an index of a friendly attitude and the fact that the New England association last March waived the payment of the regular entrance fee for members of the American association who desired to join and that the American association extends similar courtesies, is significant of a spirit of cordial relationship.

Sooner or later the question of an amalgamation must be definitely decided. There is ample time for thought on this important matter and in arriving at the answer petty motives and ambitions must be cast aside and the outcome must be founded upon a broad-minded view of the whole situation, considering only the greatest good to the profession at large.

Engineers in a National Crisis

CONSIDERING the somewhat menacing turn affairs are taking, it is a great pity that the projects already on foot for at least an informal organization of engineers in behalf of National defence has not been pushed further along. It is to be hoped that the present crisis will be passed without actually coming to open hostilities, but it is reasonably certain that a situation has developed which makes it desirable to know where one might find an organized body of trained engineers in case their services were to be needed. Hardly a single branch of engineering fails to find its work set for it in actual or impending hostilities. Civil engineers, who are possessed of a reasonable degree of initiative, can be turned into military engineers very quickly, and chemical, electrical and mining engineers will find themselves working overtime if there be any real trouble.

The pity is that the plans, already partially formed, were not carried out a year or two earlier, so that a big organization would be available in case the course of events should unfortunately lead to other than a peaceful ending. During the Spanish War a small body of skilled engineers was hastily gotten together to assist in submarine mining work and did sterling service at several points along the coast. It was quickly and efficiently organized, yet under other circumstances it might have been needed acutely before even the short time elapsed in which it was ready for service. The experience of that emergency showed that it is perfectly possible to get together for this particular work a highly effective force from material at hand. The same would be true of other branches of engineering, and it certainly is time to push the projects which already have been forming, so that the country may not be caught unprepared again, even if it should pull through the present difficulty with no serious results.

Action along this line is the more imperative because the present European war again demonstrates what has already been obvious, that a war of the most formidable character may break out within so short a time as to give absolutely no warning sufficient to do any preliminary work of organization. The conflict which began last August started with barely a week between locally strained diplomatic relations, promising a peaceful solution, and actual war. Everybody knows in what a shocking state of unpreparedness the United States was found in 1898, and those who are well informed know only too well that it is not now in much better condition.

One of the weakest points of our particular Government is the difficulty of dealing with a sudden and dangerous emergency, especially when Congress is not in session. There is no provision in our Governmental system for any intermediate condition between placid peace and open hostilities. The Executive has, in a somewhat vague form, very large powers, but these cannot be efficiently exercised until war actually breaks out and even then at some inconvenience. Active precautions against being caught unawares by a declaration of war are extremely difficult. In 1898 the situation was relieved by a big appropriation and authority to use it, but, even so, everyone will remember the scandalous wire-pulling and dickering and unloading of worthless material, which took place in the weeks preceding the declaration of war, due to the fact that many things had to be done by indirection with all the organization still on a peace footing.

There is a great deal to be said for the German scheme of a specific recognition of impending danger, placing things automatically in condition for prompt and thorough action. In case of real danger a chief executive with the courage of his convictions could, and probably would, do a good deal on his own initiative, yet he would be greatly handicapped by lack of formal recognition of the propriety of his acts. Certain necessary things he could only do by declaration of martial law, which certainly creates an inconvenient situation, especially when diplomacy is still active in trying to reach a peaceful solution of existing difficulties. There is real need of well defined means for taking up the necessary work of defence without going to this length, and this applies particularly to proper organization of auxiliary forces such as a trained body of engineers.

In 1898 the engineering force which was actually organized was enlisted wholly by private initiative and put into service, so to speak, by subterfuge, since there was no law under which it could have been properly mustered in at the time when it was really needed and actually got to work. It is assuredly undesirable to get caught again in the same way, and, while a peaceful solution of all questions now pending may fairly be anticipated, a proper organization of engineers to take a hand if need be is highly desirable.

Methods Introduced in New York Last Winter Cut Cost and Increased Speed of Snow Removal

Record Shows Saving of 75 Per Cent and Quadrupled Rate of Cleaning When Compared with Averages Over Period of Years

By JOHN T. FETHERSTON
Commissioner of Street Cleaning, New York

TWO FORCES were employed by the city on snow work in New York last winter: the "snow-fighting" force, organized and managed directly by the Department of Street Cleaning and the "snow-removal" force, operated by contractors. The snow-fighting force was rather a novel addition to previous practice, in which removal by trucks was the only system in operation.

A summary of results secured by comparison with previous records shows:

(*A*) *On truck-capacity basis of removal.*

Rate of removal per day last winter increased 4.71 times and cost per cubic yard decreased 77.3 per cent, compared with average results between 1907-1914.

Rate of removal per day last winter doubled, compared with the best previous record (1914) and the cost per cubic yard decreased 67 per cent, compared with the lowest previous record (1908).

(*B*) *On area basis of removal* (area street surface multiplied by depth of snow), considering only the "snow-fighting" force:

Rate of removal per day last winter increased 3.35 times and cost per cubic yard decreased 80 per cent, compared with average results between 1902-1907.

Rate of removal per day last winter doubled and cost per cubic yard decreased 75 per cent, compared with best season's record (1906-1907).

THE SAVING

The increased speed of removal and reduced unit cost should be credited to the new method of snow fighting, using sewers for disposal.

It was necessary to work on three storms, with a combined fall of 22.4 in., and the total cost for the winter was $523,892. If all snow in 1914-1915 had been handled by contractors' trucking forces alone, the season's work, at the lowest previous contract rate ($0.367 per cubic yard in 1907-1908), would have cost $1,584,882.

Weather conditions after the snow storms, however, were favorable for dispersal by melting, yet as a matter of conservative judgment, there is little doubt that the new system saved the city at least half a million dollars and spared the Commissioner of Street Cleaning the usual unintelligent criticism.

SNOW FIGHTING

The snow-fighting force consisted of emergency laborers working under sweepers as gang leaders, supervised by regular officers of the department. About 40,000 men registered for the snow-fighting force in November and December, 1914. Cards were made for the emergency laborers and sorted according to police precincts. Cards were likewise provided for all regular employees of the department and for other city employees drafted for snow-fighting work. All cards were sent to the various police stations, ready for distribution by patrolmen.

The responsibility for starting snow-fighting work involved the exercise of judgment in determining whether or not the snowstorm warranted action costing approximately $50,000 per shift. Between December, 1914, and April, 1915, there occurred nineteen separate storms, starting with or accompanied by snow and sleet. Practically all of these were of an uncertain character, with weather indications generally pointing to a rise in temperature, followed by rain or warmer weather, so that it was not feasible to start snow fighting when the storm began. This condition resulted in some delay in beginning work on three storms, but was repaid by the fact that no mistakes were made in starting unnecessary work.

SNOW PLOW ON MOTOR TRUCK QUICKLY OPENS STREETS TO TRAFFIC

THREE WORKING STORMS

Of the three working storms, the first began on Feb. 1 with rain, turning to sleet about 9 p. m., and followed by falling temperature and the formation of ice on the pavements. The storm continued until 6.35 p. m. of Feb. 2, during which time 1.9 in. of sleet and 0.5 in. of snow accumulated. Word was sent out to call the snow-fighting force at 12 m. of Feb. 2, and one shift started, finishing at 1 a. m. on the 3rd. On Feb. 3 and 4 another snowfall, amounting to 2 in., made the total depth of snow, ice and sleet on the ground 4.5 in.

The second working storm began at 5.25 a. m., March 6, and continued until 10.02 a. m. of March 7, during which time 7.7 in. of snow fell. The call to work was sent out at 8 p. m., March 6, and two shifts of emergency laborers were employed.

The storm of April 3 was entirely unexpected and made a record as the greatest April snowfall in the history of the local Weather Bureau—10.2 in. The call for automobile snow-plows was sent out at 1 p. m., April 3, and the call for emergency laborers at 3 p. m. Three shifts of emergency laborers worked continuously from 3 p. m. until 10 p. m. of the succeeding day, which was Easter Sunday.

The time allowed for calling out, assigning and actually starting snow-fighting work throughout the Boroughs of Manhattan, The Bronx and Brooklyn was four hours, and the results indicated that it was feasible to turn out all men who reported within the time limit set. For the storm of Feb. 1, 12,518 emergency laborers were provided with badges, tickets and equipment, and at work on the assigned areas within four hours. The storms of March 6 and April 3 occurred on Saturday afternoons, and it was not possible to get a full quota of emergency laborers, but in each instance about 9,000 men were actually at work within four hours after the word was sent to the Police Department.

In spite of the unemployment situation in New York City during last winter it was not possible to secure the required number of emergency laborers on snow work. For example, on the storm of April 3 three shifts of 12,000 men each were required, and only 21,000 men in all were secured, thus leaving 15,000 vacancies.

BONUS PAYMENTS

In order to attract labor the city offered 30 cents per hour for work while the storm was in progress and 40 cents per hour for the laborers and squad leaders finishing

TABLE 1—PRELIMINARY ESTIMATE OF AREAS WHICH COULD BE CLEARED BY SEWER DISPOSAL AND AREAS ACTUALLY CLEARED BY THIS METHOD IN THREE STORMS

	Preliminary Estimate						Area actually cleared by sewering					
	Street area with good sewers (a)		Street area with doubtful sewers (b)		Street area useless, sewers or no sewers		Storm of Feb. 1-3		Storm of March 6-7		Storm of April 3	
Borough	Total street area for snow fighting, Sq. yd.	Sq. yd.	Per cent of total street area	Sq. yd.	Per cent of total street area	Sq. yd.	Per cent of total street area	Sq. yd.	Per cent of total street area	Sq. yd.	Per cent of total street area	Sq. yd.	Per cent of total street area
Manhattan	12,830,851	5,203,814	40½	6,301,034	41¼	1,326,053	10¼	3,084,780	24	7,818,066	61	7,797,393	60¾
Brooklyn	10,213,861	3,829,544	37½	6,158,433	60¼	225,877	2¼	659,000	6½	5,390,874	52¾	7,747,420	75¾
The Bronx	3,154,605	630,921	20	2,208,223	70	315,461	10	749,427	23¾	1,287,005	40¾	643,636	20½
	26,199,317	9,664,279	....	14,667,690	....	1,867,391	....	4,493,207	....	14,495,945	....	16,188,449	....
Averages	.....	.....	37	.....	56	.....	7¼	.....	17¼	.....	55¼	.....	61¾

(a) Sewers with 2-in. depth of normal flow. (b) Sewers with less than 2-in. depth of normal flow.

their assignments within the time set. Only thirteen squads were able to complete the work and earn the bonus during the season. In the first storm the snow weighed 36 lb. per cubic foot, and the allowed capacity per pan-scraper load, 4 cu. ft., was actually reduced to about 1 cu. ft. in practice; thus no snow squads were able to complete the required task. The snow for the second storm was likewise very dense, weighing 29 lb. per cubic foot, but greater progress was made through the experience gained in the preceding storm, and thirteen squad leaders in charge of 117 men were able to complete their task within the set limits. In the storm of April 3 work was not started until a large amount of snow had accumulated on the streets, and the rate of snowfall for the greater part of the storm was nearly 1 in. per hour. The weight of snow was 11 lb. per cubic foot, which was about the average weight used as the basis for assigning tasks. During this storm none of the leaders earned a bonus for cleaning their routes within the required time.

It was apparent that the bonus plan did not prove entirely successful, yet there is no doubt that the effect was to secure more work from emergency laborers than if no bonus method had been in operation.

USE OF SEWERS IS AN IMPORTANT FACTOR IN SNOW FIGHTING IN NEW YORK

END DUMP CARS DISCHARGE LOADS DIRECTLY INTO MANHOLES

USE OF SEWERS

Only two bona-fide cases were reported where disposal of snow in sewers flooded cellars, and the difference in elevation between the sewer and the cellar in these instances was so slight that flooding might have occurred during a heavy rainstorm. So far as is known at this time only slight damage was done to the sewer manholes, due to cartloads of snow causing washed out masonry joints and minor breakages.

The department estimated last December the area of streets containing sewers suitable for disposal of snow by the snow-fighting force. Table 1 compares the street area deemed susceptible of snow disposal by sewers with the street area actually cleared by sewering during and after each of the snowstorms.

As the work during the progress of the March and April storms was performed on Saturday and Sunday, the ordinary flow of sewage, especially in the manufacturing and business districts, was at a minimum, and water from hydrants was used to supplement the sewage flow. It was estimated that about 40,000,000 gal. of water was used in this way.

STATISTICAL RESULTS

Table 2 compares this season's work with the average of six preceding years of snow removal and includes the results of the snow-fighting force, combined with contract snow removal. It should be noted here that the 1915 work is reduced to a truck-load basis, but as sewered snow was not measured by truck loads, an allowance of 50 to 65 per cent shrinkage was made on the area and depth of snow cleared by the snow-fighting force. This shrinkage was based upon Weather Bureau reports and a comparison of time of removal, snowfall and truck capacities. It represents the best data available in reducing the quantities to a uniform basis.

To secure a more direct comparison of the snow-fighting work, records of snow removal on the area system, which took no account of shrinkage, were compiled and are summarized with the snow-fighting record of 1914-1915 in Table 3.

SNOW-PLOWS

In addition to the horse-drawn snowplows used to open roadways, twenty-six plows, fitted to commercial auto-trucks, were

TABLE 2—COMPARISON OF SNOW REMOVAL WORK ON TRUCK-CAPACITY BASIS

Winter	Number of working storms	Depth of working storms, inches	Days worked	Total yardage removed	Total cost	Cost per cu. yd.	Rate of removal, cu. yd. per day
1907-1908	4	23.0	45	1,125,447	$413,556	$0.367	25,009
1909-1910	3	30.0	44	1,873,236	1,405,628	0.75	42,573
1910-1911	5	23.7	46	2,625,716	1,470,904	0.56	57,081
1911-1912	5	17.7	39	1,590,235	870,389	0.547	40,775
1912-1913	1	11.8	8	496,047	245,623	0.495	62,006
1913-1914	3	38.2	43	5,180,825	2,473,343	0.477	120,484
Averages	3.5	24.1	37.5	2,148,584	1,146,574	0.533	57,296
1914-1915	3	22.4	16	4,318,481	523,892	0.121	269,905

TABLE 3—COMPARISON OF CONTRACT SYSTEM (1902-1907) IN MANHATTAN AND THE BRONX WITH SNOW FIGHTING (1914-1915) IN MANHATTAN, THE BRONX AND BROOKLYN ON AREA BASIS

Winter	Depth of working storms, inches	Days worked	Total yardage removed	Total cost	Cost per cu yd.	Rate of removal, cu. yd. per day
1902-1903	24.2	24	2,001,114	$452,719	$0.226	83,379
1903-1904	26.6	49	3,901,880	596,897	0.156	79,630
1904-1905	53.7	66	10,603,795	2,071,700	0.195	160,664
1905-1906	17.8	20	3,592,934	540,043	0.150	179,647
1906-1907	41.4	54	14,681,869	1,757,782	0.119	271,886
Averages	32.7	42.6	6,956,318	1,083,828	0.156	163,294
1914-1915	22.4	16	8,768,346	271,356	0.031	548,022

placed in service and used during the snowstorms of last winter, with generally satisfactory results, except in the first storm, when most of the plows were disabled by the excessive density of the snow and a coating of ice on the pavements. The cost per mile plowed averaged $11.28, which was considerably higher than the estimate, on account of delays and broken parts caused by the first storm.

GENERAL CONCLUSIONS ON THE SEASON'S WORK

While it is true that the snowfall was not excessive and that weather conditions were much more favorable than in the previous winter, yet the general situation in 1914-1915 was not unlike that of the preceding years, except 1913-1914. It has been the rule in New York that snowstorms were followed by a thaw within two or three days after the storm ceased. This did not occur in 1914, but it happened after the February storm in 1915. In the March and April storms the snow was practically cleared from the surface of the pavements before a thaw set in or rain fell. In downtown Manhattan after the March and April storms the roadways were cleared before the property owners removed snow from most of the sidewalks.

On the whole, the first year's experience with the snow-fighting force has been encouraging, and with slight modifications the system will be continued next season. Certainly the results secured warrant the belief that practically all sewers can be used for the disposal of snow, including pipe sewers greater in diameter than 12 in. It has been demonstrated beyond reasonable doubt that the sewers are not injured if clean snow is deposited therein while the storm is in progress.

The basic principle of the snow-fighting plan, that of starting with or during the storm and fighting it, proved satisfactory, though it is probable that with more adverse weather conditions, including low temperatures and a blizzard, it would not be possible to secure laborers in sufficient numbers to work while a storm is in progress. Yet even conceding this as a fact, there still remains the possibility of working after the storm is over, and using the sewers for snow disposal. It is quite apparent that speed can be increased and cost can be reduced by utilizing the snow-fighting principle with disposal by sewers, and it is all the more remarkable that this fact had not been recognized heretofore, as the sewers have been available in New York ever since the city existed.

The planning, organization and management of snow work were under the general direction of the writer. Andrew E. Kalbach, deputy commissioner, was in direct charge of the work, assisted by Charles B. Largy and Charles Mauro, deputy commissioners; Raymond B. Carver, examining engineer; A. A. Taylor, snow inspector; A. F. Gunther, general superintendent, and R. W. Parlin, of the engineering staff of the Bureau of Municipal Research.

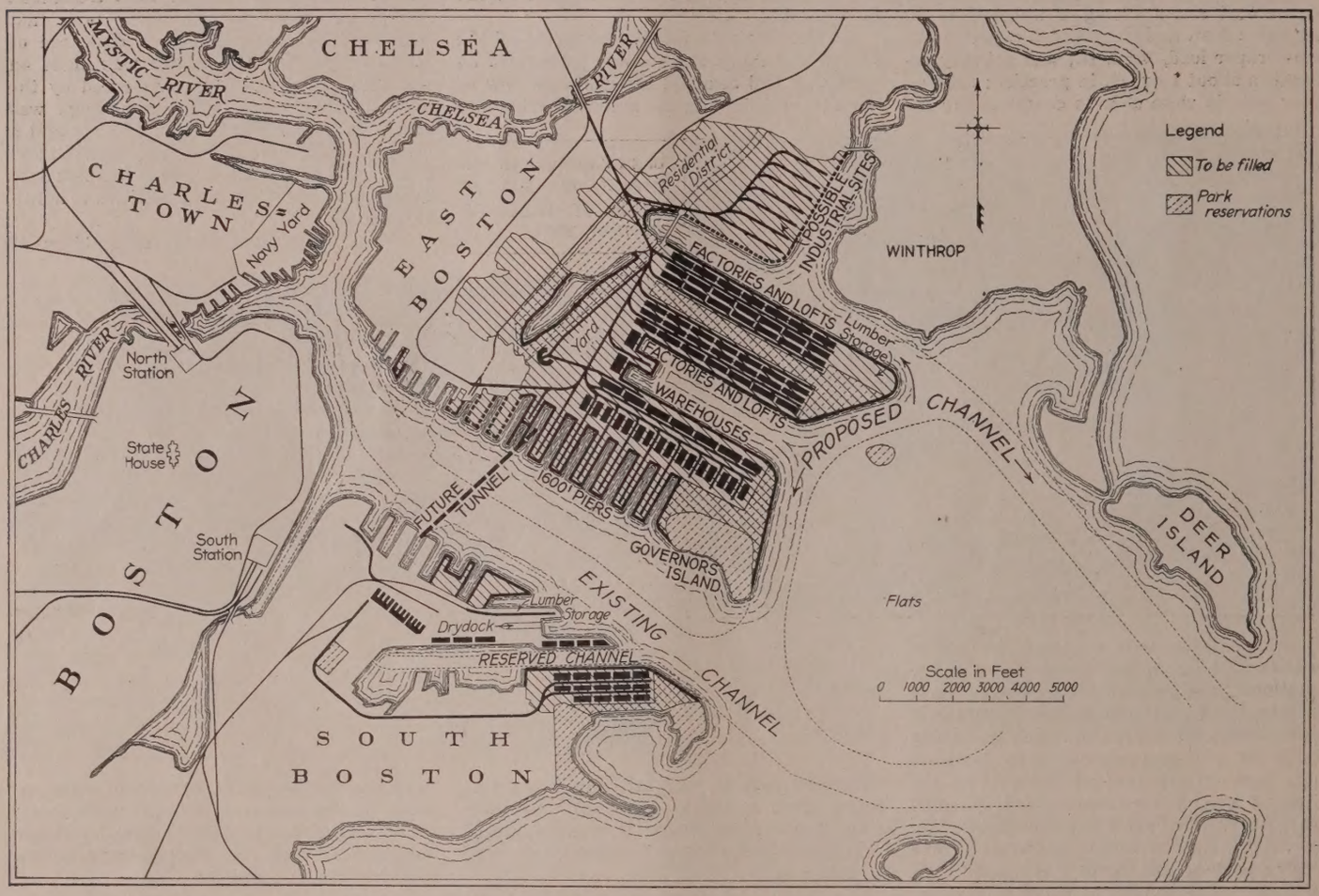
THE EXTENSIVE NEW FREIGHT TERMINALS of the St. Louis Southwestern Railway (Cotton Belt Route) at Fort Worth, Texas, states C. D. Purdon, chief engineer, were opened for traffic May 1.

Boston Proposes to Extend Eastward Into Bay

Directors of the Port Present Plan to Develop Large Terminal Tract by Filling from East Boston to Governors Island

AN AMBITIOUS plan for extending Boston's port facilities by filling the flats between East Boston and Governors Island, and in a smaller way extending South Boston eastward along the main harbor channel, is presented in the supplementary report recently issued of the Directors of the Port of Boston. The accompanying map is self-explanatory and requires little comment. The extension to Governors Island would be about 2 miles long and 1½ miles wide over all, the interior basin being 5000 ft. deep and 1500 ft. wide. Over most of the area the water is only a few feet deep, and the sand is exposed over a large part of it at low tide.

In order to carry out the improvement permission must be obtained from both the State and the United States to change the pierhead lines. An enabling bill has passed the Massachusetts Legislature, and a hearing by the Federal Government has been set for May 25.



PROPOSED EXTENSION TO PORT OF BOSTON, IF CARRIED OUT, WILL UTILIZE SUBMERGED LANDS OPPOSITE EAST BOSTON

OWNERSHIP IN GREAT LAKES STEAMERS by railroads is prohibited after Dec. 1 by a recent order of the Interstate Commerce Commission. The trunk lines affected include such roads as the Lehigh Valley, which terminate at the Great Lakes, as well as those like the New York Central, which have rail lines paralleling the water routes.

Consolidation of Country's Waterworks Associations Urged at American Convention

George G. Earl, in Presidential Address at Cincinnati Meeting, Advocates a National Organization, Embracing All Existing Waterworks Bodies, to Reduce Wasted Effort and Expense

SMOULDERING unobtrusively for a long time past, the subject of a national waterworks association, to replace the existing separate waterworks bodies in the United States, was fanned into flame by George G. Earl, general superintendent of the Sewage and Water Board of New Orleans, in his presidential address last week before the thirty-fifth annual convention of the American Waterworks Association in Cincinnati. While no specific mention of the associations to compose the proposed national body were made it is clear that his remarks place squarely before the waterworks men of this country the issue of an amalgamation of the American and the New England waterworks associations. The chief advantages of such a coalition, Mr. Earl said, would be to eliminate duplication of committee work, reduce the time and expense of attending two conventions, and call for the preparation of fewer technical papers and reports by busy men. He argued, in effect, that there are two large associations covering the same field when one could do the work effectively. That the realization of Mr. Earl's project is near at hand is doubted by those best qualified to sense the sentiment in both bodies. Certainly the indications are that the result is not to be achieved in a year or two.

President Earl's Address

Mr. Earl said in part:

"In looking over the volumes of this association's 'Journal,' and journals of other associations as well, perhaps the most conspicuous thing is the scope of topics which present themselves as allied with and essential to the present day waterworks practice. A generation ago an able man might specialize in waterworks and reasonably well cover the field. To-day, a rather modest waterworks outfit demands specialists in several lines to cooperate in its attainment and its maintenance and operation. Aside from the pleasant social intercourse, the greatest good of this association lies in the lesson of the necessity of cooperation in any worth while accomplishment which it brings home to each of us. It is around this central idea of cooperation that I shall now speak, in its application not only to the individual waterworks plant, but also to this association, to the whole waterworks interests and to the interest of humanity itself.

"Broadly speaking, nothing is worth while which does not advance the interests both of justice and of humanity, and any work undertaken which conforms with these objects should appeal to the people in whose interest it is undertaken. Tactful voicing of this appeal, with clear and candid statements rendered to the public, are essential to the promotion of that cooperation from this source without which no work can prosper.

"Not long ago I had the pleasure of dining with the head of one of the country's greatest corporations, and, when the opportunity offered, I asked him what, in his experience, was the hardest vital thing to attain in his management of its affairs. His reply, without any hesitation, was 'to keep everybody boosting, not to keep them boosting me, to keep them boosting the corporation—that is easy—but to keep them boosting one another.' In other words, effectively, helpfully and unselfishly cooperating.

"The very qualities of great personal ability and self-reliance, which render many men of inestimable value, tend in some degree to destroy in them the spirit of cooperation and tolerance which are, and always will be, essential to the team-work, without which the highest success of great undertakings can never be attained, and without which, as their responsibilities grow, they will find themselves unable to progress as they might otherwise.

"The organization which has a chief who cannot learn anything from or give any credit to his subordinates, and as a sequence, or even without this inciting cause, has subordinates who are working at cross purposes with their chief and with one another, is seriously handicapped, not only in its actual work, but also in maintaining the public confidence and cooperation which a united front can maintain, and which is essential, not only to its well being as an organization, but also to the well being of the individuals composing it.

"The great purpose which associations like the American Waterworks Association are accomplishing is in obtaining a constantly wider and more effective cooperation in the diffusion of knowledge and the interchange of ideas looking to the improvement of the various factors which enter into the waterworks practice of today. The more interested men, and the more trained men, and the more men, who desire to broaden themselves in this field of usefulness, that can be induced to cooperate to these ends, the better will be the results.

Duplication of Effort

"Other more or less local waterworks associations hold meetings and publish valuable papers and reports which this association could profit by, and these associations in turn themselves could profit equally by the papers and reports of this association. Very few waterworks officials can spare the time or money to attend several conventions each year, and relatively few can belong to two or three associations and keep up with their papers and reports, and those who have special experiences or ideas of value cannot spare the time, or for one cause or another do not care to repeat substantially the same paper to two or three associations. And when it happens that standards have to be adopted, or any general movement is in progress looking to the interest of the whole waterworks fraternity, the multiplication of unaffiliated associations is a distinct cause of complication and delay.

"Many of us belong to and take great pride in our membership in some of these associations, but holding to the conviction that the greatest good is to be obtained by the broadest possible cooperation, and being unable to attend more than one convention we have to forego the pleasure and profit which we would have in meeting more of the membership of the other associations than attend the conventions of this association, and therefore lose the opportunity which might otherwise exist of receiving from or imparting to them much that would be of mutual interest and helpfulness; while those of our members who are able to attend several conventions, and to do their full duty by presenting to two or more associations papers covering valuable contentions in waterworks matters, are performing a most arduous and unnecessary double duty.

A Union of Interests

"There seems, therefore, to be every possible reason for the union of all of the waterworks associations of America, with as many local branches and branch conventions and headquarters as can be maintained, but with one national annual convention and one common publication of all papers covering new matter of general interest. A splendid start in this direction has been made through the present very liberal conditions and regulations offered by this association for such consolidations and three very desirable connections have already been consummated, with others in prospect.

"I believe that the best interests of all waterworks associations demand that this movement be continued and accelerated, and the advantages to be gained by all parties of a more prompt and effective cooperation from such consolidations would be so great as to warrant the highest effort and the greatest of mutual concessions. Fortunately, the relations between these various organizations have heretofore always been most pleasant.

"A national waterworks association that included every existing organization and reached every waterworks in the country could do better work and it could, through its larger membership, make its work count for more in the obtaining of general public faith and cooperation in its standards and suggestions.

Problems Which Need Attention

"The progress which the physical side of waterworks problems has made, and is making, speaks loudly and truly of the unselfish cooperation which has always existed and still exists between the allied professions whose efforts are responsible for the advance which by its very momentum must continue. The end which lags and which should be given the best effort of your best minds, however, has reference more to the matter of water rates and accounts and to the means and relations which exist in the matter of connections from the main to the property line, and in the matter of the maintenance of such connection and of the meter which should exist on each connection."

Standard Apparatus and Procedure Recommended for Sand Analysis

Philip Burgess Suggests at American Waterworks Convention That Standard Methods Be Adopted by All Sand Users

THAT sand for filters, for concrete and for asphalt should be analyzed by the same standard apparatus and procedure was the contention of Philip Burgess in a paper read last week at the convention of the American Waterworks Association. From his paper these notes have been abstracted. It is recommended that standard sieve sizes rather than the actual size of the sand grain be adopted, thus eliminating the phrases "effective size" and "uniformity coefficient," which are arbitrary and have no significance outside of filtration work.

Some of the reasons for the necessity for standard methods are the increasing demand by engineers for better concrete sand specifications, the fact that the term "effective size" is not entirely satisfactory as applied to rapid-filter sand, and the confusion on the part of the manufacturers of sieves, who find it difficult to satisfy the specifications and requirements of engineers.

The economic features are evident in the case of concrete where the frequent weak and ambiguous specifications tend to increase the cost of the work and often to yield unsatisfactory results. From the filtration standpoint local sands are often available, but on account of lack of knowledge on the part of the local contractor, or on the part of the engineers in charge, such sands are seldom used. In consequence sand is often imported from considerable distance at an undue expense.

Much of the confusion has arisen from the arbitrary terms used by sanitary engineers, terms which have little or no significance to an ordinary contractor or the sand merchant in the business of sizing sands.

Confusion in Size Standards

Moreover, a further confusion has arisen from the endeavor to use the actual sizes of the sand grains rather than the sizes of the openings in the screens. It was early recognized and appreciated that there may be considerable variations in the sieve used for testing purposes in respect to the diameters of the wires and the spacings of the mesh. Consequently it was considered that the nominal spacings of the meshes per inch were of no consequence in determining the separation of a sieve. This view of the matter required a determination of the relation between the average diameter of the openings and the size of separation of a sieve, or more properly the determination of the actual size of separation of a sieve. Since few engineers have available the equipment required to standardize sieves, the results of analyses have been reported in many instances in terms of numbers of meshes or in wires per inch. This method of expressing results is indefinite and inaccurate, because wire cloth used in the manufacture of sieves frequently varies in the size of wires and number of meshes per inch.

Within recent years this difficulty has been appreciated by manufacturers, some of whom have endeavored to clear up the matter by producing standard testing sieves made in accordance with recent standard specifications and with certain arbitrary intervals of spacings between the individual units. By such means it is hoped to fix definitely the diameter of the openings in testing sieves. Recently the Bureau of Standards of the Department of Labor and Commerce at Washington has adopted standard specifications covering the manufacture of certain testing sieves; also, when solicited, this department stands ready to rate and standardize testing sieves at a nominal cost with a view of determining the actual average diameters of the openings.

Change from Sand Grain to Sieve Opening

The engineering profession should adopt a standard method and standard apparatus for making mechanical analyses of sands and gravels. It is believed also that simplicity and accuracy in reporting the results would be obtained by revising the methods commonly used at present to report such analyses. Possibly that feature which would tend most to clear up the situation would be to change the standard of measurement from the size of the sand grains to the size of opening in a sieve. In view of the fact that the coarser testing sieves such as are required for sand analyses can now be obtained with wires of very nearly uniform sizes and accurate spacings in both directions, it follows that such sieves will, within reasonable and sufficient accuracy, contain openings of certain definite sizes.

One of the difficulties to be encountered in such a change of standard would be to compare previous analyses with present or future requirements and conditions. Some years ago, at Philadelphia, a great many tests were made to determine the sizes of separation of two nests of sieves; also, to determine the relation between such sizes of separation and the diameters of openings in the screens. The average ratio of size of separation to size of opening was found to be 1.10 and was a constant within the limits of accuracy which can commonly be secured in making a mechanical analysis of sand.

Some of the finer sieves examined contained twilled cloth and not plain woven cloth. The average ratio of the size of separation of the twilled cloth to the average diameter of the openings was found to be 1.18. This comparatively large ratio of separation to diameter of opening in such sieves has been stated to be one reason why there is no constant relation between the diameter of opening and the separation of a sieve. As a matter of fact, however, no difficulty need be encountered in obtaining plain woven wire cloth, even for the fine sieves, so that a nest of sieves may readily be obtained with a practically constant ratio of sizes of openings to sizes of separations throughout.

In determining the relation between the separations and openings in the sieves at Philadelphia, there were counted more than 250,000 sand grains and the work extended over a period of two months. The sieves were rated and re-rated until the curves of analyses obtained by examinations of the same sample of material by the two sets of sieves coincided throughout their entire length. Great care was taken, also, to secure accurate measurements of the diameters of the wires and of the number of meshes per inch in both directions, from several parts of the area of the cloth.

How to Help the Sand Contractor

Attention is drawn to the marked differences in engineering specifications and requirements for the preparation of sands used for filtration purposes. Frequently such specifications are limited to an expression of the maximum and minimum effective size and maximum and minimum uniformity coefficient. These terms mean nothing to the ordinary contractor who must furnish the material. It is obvious that the whole question of obtaining satisfactory material would be very much simplified if the specifications would read that a satisfactory sand would be one which contains not more or not less than certain specified quantities as separated by certain standard sieves. Such standard sieves would be available for the contractor, or manufacturer of the material, as well as for the engineer in charge of the work, who, under present circumstances and conditions, has the matter almost entirely in his own hands. This is true in regard to specifications for sand required not only for filtering material but also for any other purpose.

It is significant that the difficulties of the present situation are appreciated by some of the manufacturers of screens and testing sieves who have, in some cases, in their trade publications, gone into a discussion of testing sieves rather thoroughly with a view of meeting the demands of the engineering profession. The intervals between the wires of one company's sieves, or the diameters of the openings in the sieves, increase in a certain definite ratio, namely, the square root of 2, or 1.414. This ratio has certain obvious advantages because it permits the selection of sieves which give accurate ratios of separations of 1.414, 2, or 4 to 1.

It is believed that there would be a great advantage in simplicity of expression of results of analysis or in the form of specifications covering the preparation of filter sands if a statement were made to the effect that 10 per cent of the sand passes, or shall pass, a standard sieve No. 35, or a standard sieve having an opening of 0.417 mm in diameter, as compared with the usual statement that a sand has, or shall have, an "effective size" of 0.46 mm. Moreover, the term "effective size" has no significance whatever outside of its application to a filter sand, and, of itself alone, the term is of doubtful value as applied to sands such as are frequently used for rapid-sand filters. The range of sizes is believed to be much more significant.

Discussion by Allen Hazen

The writer feels disposed to insist that it be demonstrated that the changes proposed by Mr. Burgess represent a real advance before they are adopted, and in the present case he feels that some of the changes suggested would be unfortunate, and would not mark an advance in the art. Mr. Burgess speaks of the necessity of having the standards equally applicable to all the various purposes for which mechanical analyses are required. In this the writer fully concurs.

The subject can well be divided into two parts. In the old method of sand analyses,

developed by the writer, the size of grain was defined in all cases as the diameter of a sphere of equal volume. This method is applicable to all cases, and the writer sees no reason why it should be abandoned at this time. The second part of the subject relates to the terms "effective size" and "uniformity coefficient." These terms were originated for the purpose of defining filter hands and for no other purpose, and it is to be recognized that they are not necessarily or presumably applicable to discussing sands, gravels or silts for other purposes.

METHOD OF RATING SIEVES

Mr. Burgess proposes to abandon the use of sizes of particles which pass or fail to pass the screens and to substitute therefor the size of mesh of the screen itself. The method of rating sieves originally proposed and in general use is to put a representative sample of sand upon the sieve to be rated, to shake it in a specified manner, and at the completion of such shaking to give it a slight further shaking, during which the material passing is separately caught, and finally to determine the grain sizes of these last particles. Experience shows that these particles are nearly all of the same size, and when that size is determined it establishes the size of separation of the sieve. The size of the particles, in most cases, is determined by weighing a certain number of them and computing the average weight, and from that the average volume and the diameter of a sphere of equal volume, which is the basis of the statement. This is a process that can be carried out with quite definite results, and it is the foundation of the whole scheme of rating and grain sizes that has been used.

In practical operations, a method of comparative rating is also used and has been found helpful. By this system, one set of sieves, dedicated to that purpose and rated with the utmost care by the method first described, is used for comparison with other sieves for which ratings are desired. The same sample of sand is sifted through the standard sieves and through those to be rated. This is repeated with several samples of sand selected to show the points of separation of the respective sieves.

The results of the analysis of each sand by the standard sieves are plotted on logarithmic paper, 20-in. base, a large scale being used to allow of the utmost precision. It is found that the analysis of natural sands plotted in this way, including about the finest half of the material by weight, plot in nearly a straight line on this paper, and it is possible from the sieves in the standard set to get a very accurate determination of the position of this line at all points. With this line plotted the percentages of material passing each of the new sieves are found upon it, and in the opposite direction is found the corresponding size of separation for that sieve.

The size of separation determined in this way is determined with reference to the original or standard sieves. Very great precision is obtainable with careful manipulation. For instance, the difference between a sieve having a separation 0.200 mm. and one having a size of separation of 0.205 mm. should be unmistakably apparent. This degree of accuracy is all that is required for practical purposes.

MESH IRREGULARITIES

This method of comparative rating is described at some length, because it has an important bearing upon the question of substituting the size of mesh for the size of separation of the sieve. The size of mesh is computed in a somewhat theoretical way by ascertaining the number of meshes per inch (best obtained by counting blueprints made from the wire cloth), by measuring with a micrometer the diameters of the wires, and by computing from these data the average openings in the two directions. They are practically never square. The wires differ in diameter by quite appreciable amounts among themselves, and no one has yet found how to weave cloth so that the space between successive wires is always the same. Under these conditions, some openings are larger and some smaller than those computed, and the majority of holes, instead of being square, are more or less irregular.

The particles of sand instead of being spheres are irregular in shape, the long, middle and short diameters for ordinary sands being approximately in the ratios of 4, 3 and 2. When such ordinary sand grains are shaken upon a mesh that is not quite square, it is found that the size of grains passing is determined by the longest dimensions of the mesh and not by the shortest one. In other words, if the mesh is 0.28 mm. in one direction and 0.30 mm. in the other direction, it is the 0.30 mm. that controls, and the size of separation of such a sieve will be substantially the same as of another sieve 0.30 mm. in both directions, and also substantially the same as the size of separation of sieve 0.30 x 0.25 mm. This is not exactly true, but it is approximately so.

However, even when this matter is taken into account, there are always variations in the sizes of the openings that affect to an appreciable extent the size of separation of the sieve. For instance, if from a very carefully woven piece of wire cloth, woven for the express purpose of making sieves, and with the greatest attention to have it uniform throughout, a dozen pieces are cut close together and made into sieves and examined by the system of comparative rating mentioned above, substantial differences among the sizes of separation of the sieves are invariably found. These differences are not accidental, such as might be accounted for by differences in manipulation. They are real differences that can be substantiated by passing any number of samples of sand through the same sieves and concordant results can be obtained.

Under these circumstances, to abandon a definite and quite accurate method of designating the size of the sieve and to substitute therefor a less accurate method, is certainly not a step in advance. Examinations of various other kinds of materials involve much labor and equipment. If accuracy is to be secured in such examinations, it is imperative that the fundamental ideas upon which accuracy is based should not be neglected nor abandoned.

It is further to be noted that sifting is only one of various methods used in determining the size of particles. For instance, it is not practically applicable to particles much less than 0.10 mm. in diameter. For all smaller particles elutriation or microscopical methods must be used. Such small particles have little significance in filtration work, but in studies of materials for other purposes they are exceedingly important, and it seems desirable to the writer that the method used should be a general one that does not need to be varied for different purposes. The size of sieve opening being about 90 per cent of the size of particle, it would be necessary, in order to keep the results consistent, to use an expression to describe the size of smaller particles something like this:

"Size being about 90 per cent of actual size and taken to represent what the size of sieve would be which would pass particles of this size, if such a sieve could be made and used."

Similar definitions would be necessary to describe larger particles separated by round openings in metal discs, which are more convenient and accurate for particles 2 mm. and over in diameter.

UNIFORMITY COEFFICIENT

The writer is interested in Mr. Burgess' statement that "the term 'effective size' is not entirely satisfactory, because the range of sizes of sand permitted in rapid sand filters frequently is very much less, etc." This is precisely the point where the uniformity coefficient is useful. The need of having some method of expressing the degree of variation in the sizes of the particles of sand was recognized when the present method of sand analysis was devised, and it is no less essential now than it was then. In the light of all the experience in 25 years since, and with a study of recent development in the art of statistics and methods of statistical expression, the term "uniformity coefficient" seems to measure up very well to modern standards. It is possible that the words "uniformity coefficient" could be now improved upon. On the other hand, the modern equivalent "coefficient of variation" has a precise definition and it should be used only for exactly what it is defined to mean in books of statistics.

The data of sand analysis cannot be treated in a way so that the "coefficient of variation" can be easily computed. The "uniformity coefficient," however, which is easily determined by the methods now in common use, would be proportional to the "coefficient of variation," if that could be computed, and is equally as useful in the interpretation of sand analyses, and as long as it is not identical, it seems better to retain a distinctive expression for it.

The effective size was defined as such that 10 per cent by weight of the particles were smaller than it. This has seemed to many as a somewhat arbitrary and rule of thumb procedure. However, it was based upon very good underlying data.

The filtering materials for which data were available at Lawrence when the method was adopted comprised sands with quite a wide range in uniformity coefficients. Data for frictional resistance, capillarity, etc., for these sands were available. Comparative studies showed that if 8 per cent was taken as the limit instead of 10 per cent, an unduly great weight was given to the effect of the finer particles upon the physical properties of the material; while if 12 per cent were taken, the effect of the finer particles was inadequately represented. The Lawrence data were very clear upon this point, and the 10-per cent limit was selected because this brought all the materials for which data were then available into their correct relative positions with respect to frictional resistance and capillarity.

There is no reason to suppose that 10 per cent is a precise mathematical limit always true of all materials. Nevertheless, prac-

tical experience extending over 25 years and to many thousand samples of sand and the collection of large amounts of additional data on physical properties, has failed to show any way in which the original expression could be improved in a substantial manner.

The writer is interested in the improvement in the methods of weaving cloth for sieves and of the suggested arrangement for a set of standard sieves. The arrangement proposed seems an excellent one, and if it can be carried out to give sufficient regularity in mesh opening, he would heartily support it, but would urge that the sieves, nevertheless, be rated in all cases and that the actual size of separation be used in discussing the results, rather than the supposed size of separation computed from the nominal or even the measured average mesh and size of wire.

ALBANY FILTER SPECIFICATIONS

The writer also notes the suggestion that engineering specifications should be written so as to provide the percentages that should pass sieves of certain sizes. Mr. Burgess has evidently overlooked the fact that all the earlier specifications for sand and gravel drawn in this office, and frequently copied in other early specifications, were drawn in the way which he now proposes. For instance, the Albany filter specifications required that "The grains..... shall be of the following diameters; not more than one per cent by weight shall be less than 0.13 mm, nor more than 10 per cent shall be less than 0.27 mm; at least 10 per cent by weight shall be less than 0.36 mm, and at least 70 per cent shall be less than 1.0 mm. No particles shall be more than 5.0 mm diameter."

The method was a perfectly satisfactory one and has much merit. As the years have gone by and contractors have become accustomed to the terms "effective size" and "uniformity coefficient," these have been written into the specifications and have taken the place of the longer schedules which had previously been used. The writer thinks that very little practical difference has been made in this change. No doubt, it is true that many contractors do not fully understand all the nomenclature of sand analysis. That is true of many other parts of our specifications.

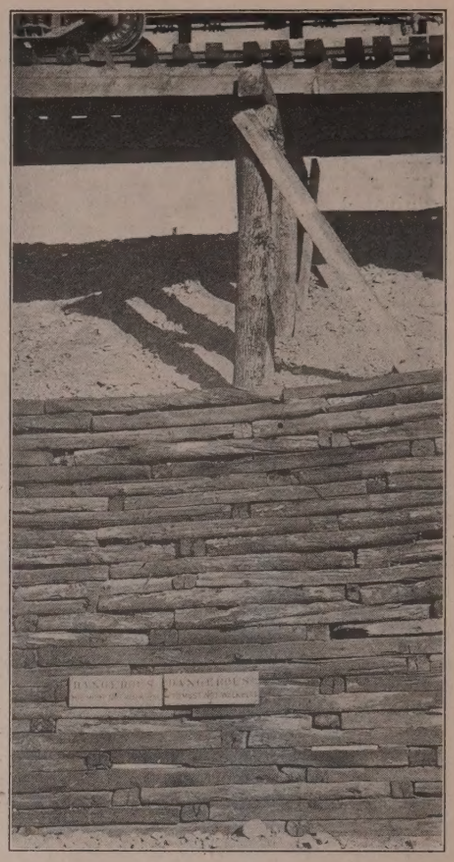
After much experience in securing sand under specifications covering, perhaps, the purchase of as large a quantity of sand and at as low an average price as would be represented by the experience of any other office in the country, the writer is unable to say that lack of understanding of these methods by contractors has been a serious obstacle in the prosecution of the business. It is certainly true, as Mr. Burgess suggests, that there are numerous excellent deposits of sand stock all over the United States that have not been used, and that much money could have been saved by more knowledge and better appliances. However, that is hardly the fault of the method of sand analysis. A general raising of the intelligence and information of those who have to do with this subject must be the foundation of improvements in this respect and of a more complete use of natural resources.

Temporary Timber Walls for Track Elevation

Old Ties Used Successfully to Heights of 37 Feet in Work of Chicago, Rock Island & Pacific Railway in Chicago

HIGH temporary timber retaining walls, located in close proximity to operating tracks over which a large volume of business is handled, were built by the Chicago, Rock Island & Pacific Railway in connection with its 1914 track-elevation work in Chicago. The walls, which extend for ½ mi. and vary in height from 4 to 20 ft., were constructed parallel to and from 8 to 10 ft. from the center of the nearest operating track, their purpose being to hold the slope of the heavy gravel fill on the easterly part of the right of way, which was first elevated. They were built of old ties, with a header in the length of each tie, one end being spiked to the ties below and the other to the second line of ties placed one tie length back of the face ties, thus making a cellular timber retaining wall. The cribs were then filled with coarse sand and gravel. An occasional tie was spiked on top to catch the larger stones as they rolled from the cars during the filling. The new roadbed and slopes were continually soaked with water during construction, both for the purpose of obtaining the minimum settlement, and to test the efficiency of the walls before regular main-line traffic was placed on the elevated portion.

WALLS AS HIGH AS 37 FEET HAVE BEEN CONSTRUCTED IN THIS WAY



OLD CROSSTIES PUT TO A GOOD USE

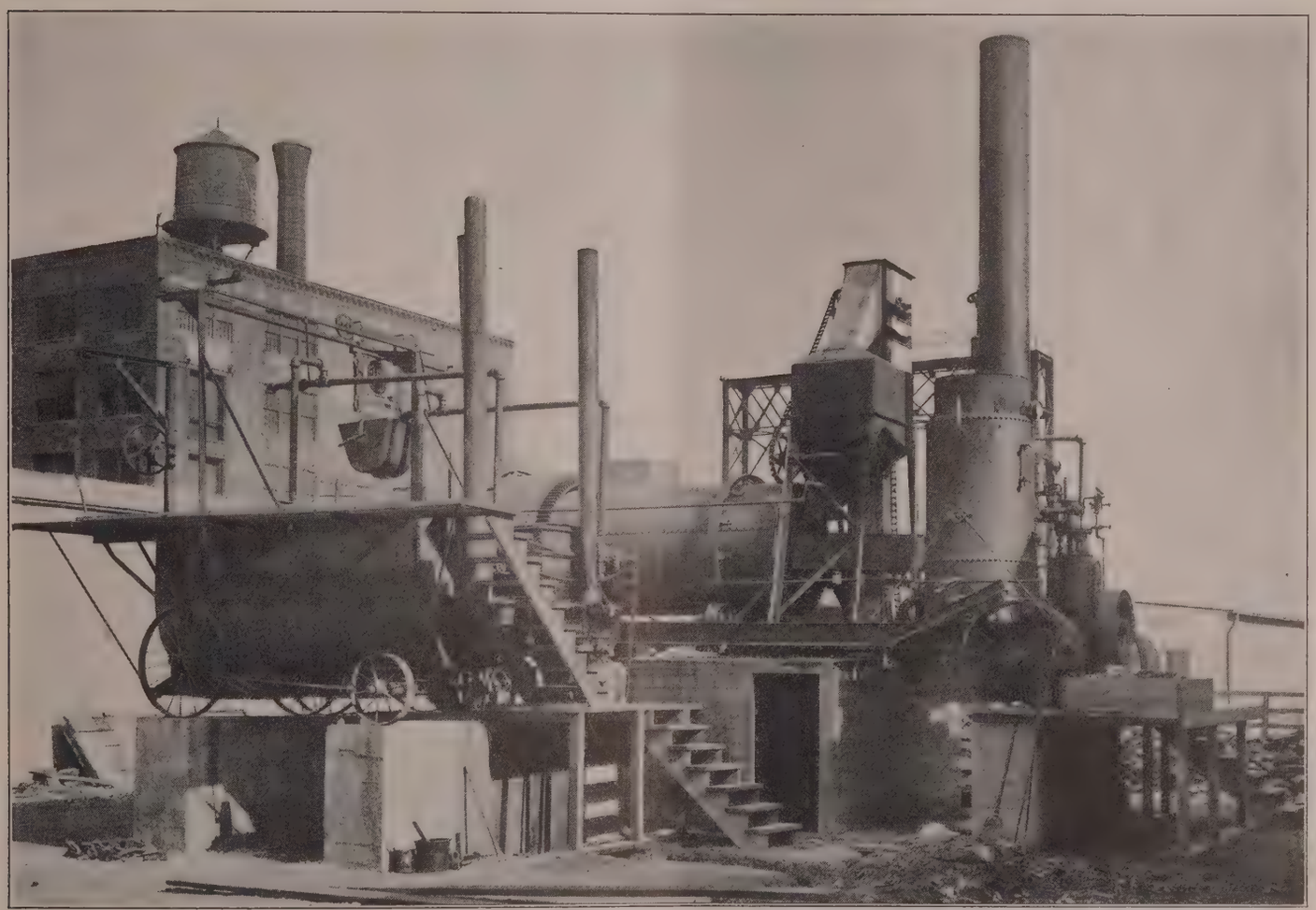
The walls have successfully retained the loads imposed on them by three main tracks, the nearest of which is 19 ft. center to center from the track below, over which traffic has also been maintained. In some places there is a difference of 37 ft. in elevation between high and low tracks. According to a statement made by R. H. Ford, engineer of track elevation for the Rock Island, in a discussion before the Western Society of Engineers, this wall has served its purpose admirably. The labor cost of the wall averaged 20 cents per running foot. A concrete retaining wall 30 ft. high, supported on piles, averages $115 per linear foot, while an 18-ft. wall without piles (the usual height for track elevation) cost $32 per linear foot. Articles on important phases of this Rock Island work, which involves an expenditure of $10,000,000, were published in the Engineering Record of Aug. 1, 1914, page 122, and Aug. 15, 1914, page 190.

THE AMERICAN PRODUCTION OF CREOSOTE will, it is estimated, be increased about 25 per cent, according to a report compiled by the U. S. Forest Service, by steps recently taken by American manufacturers. In this manner the shortage of imported oil brought about by the European war will be to some extent met. The imported oil ordinarily constitutes about 65 per cent of the total used in the United States, nearly all of this comes from England and Germany, and the shipments from those two countries have fallen off nearly 30 per cent since Aug. 1. Statistics show that there were 122 wood-preserving plants of all kinds in the United States in 1915, as compared with fifteen in 1895, and that ninety-four of these used last year more than 79,000,000 gal. of creosote oil, besides large quantities of zinc chloride and other preservatives.

City Plant Uses Old Asphalt for New Work

Material Cut from Old Pavements Is Reheated and Employed in Making of Repairs in Chicago Streets

A MUNICIPAL asphalt rehabilitation plant designed for utilizing old material cut out of pavements in making repairs has been recently placed in operation by the city of Chicago. The plant has a capacity of 10 tons per hour when binder material is made, using proportional parts of new and old asphalt. It also has an equivalent capacity for making new asphalt, using sand containing 5 per cent moisture. To date the city has not had any chance to use the plant at its full capacity. The plant is portable and its overhead apparatus can be lowered in about 30 min. to clear a 12-ft. subway, Chicago's minimum allowable clearance. It also has folding platforms so that men can easily move about it.



THE ASPHALT PLANT IS PORTABLE AND ITS OVERHEAD APPARATUS CAN BE QUICKLY LOWERED TO CLEAR A 12-FOOT SUBWAY

PUTTING NEW LIFE INTO OLD MATERIAL

Pieces of old pavement are fed into a hopper located near the bottom of one side of the plant, whence they slide by gravity to a pit beneath the plant where they are delivered to a Noyes crusher. The crushed material is then hoisted by a bucket elevator to a steel receiving bin overhead. From this bin it is fed to a heater and dryer. The hot, sticky mass is then passed to a mixer located at the end of the heater. Two 900-gal. melting kettles connected by coils and equipped with pumps are used for heating new material, which when heated is pumped into a weighing bucket and carried to the mixer, where it is dumped in with the old material.

Experience indicates that excellent binder or asphaltic-concrete surfacing can be obtained by mixing certain quantities of new and old material. The proportions are not fixed as yet, as the work up to the present time has been somewhat of an experimental nature.

The entire plant is raised on concrete piers to facilitate dumping into wagons. It is operated by electricity and is equipped to burn either coal or fuel oil, both being used at the present writing. Previous to the installation of the plant old material was carried away to convenient dumping grounds, which were hard to obtain due to the fact that asphalt is a poor filling material.

The new plant is located adjacent to the municipal plant which makes it easy for teams to carry old material from the repair job to the plant and take on a load from either of the two plants without making a haul to the dump.

The plant is guaranteed against any danger due to burning or injuring the old material, by its designers and manufacturers the Warren Brothers Company of Boston. The plant was installed under the supervision of Walter G. Leininger, superintendent of streets of Chicago.

WYOMING has approximately 1,500,000 acres of land under irrigation. With ample storage provided to hold all floods, according to J. B. True, State engineer, there is sufficient water in the State to irrigate 6,000,000 acres of land.

Cement-Sand Bed Best for Wood-Block Paving

Despite Slight Increase in Cost It Is Preferable to Plain Sand Cushion

By CLARK R. MANDIGO
Assistant City Engineer, Kansas City, Mo.

PORTLAND cement should be mixed with the sand used as a bedding course in the laying of creosoted wood-block paving for the following reasons:

1. Along streets with car lines, the rise and fall of the rail and the jar of passing cars will cause the shifting of a plain sand cushion. Where water gets in around the rail this rise and fall seems to have a pumping action, forcing the water and sand considerable distances.

2. When service cuts are made a dry, loose sand cushion may run for some distance, especially on a grade, due to the blows of cutting the foundation. This displacement of the cushion may be slight, and pass unnoticed when the cut is repaved. Any settlement of a portion of blocks causes unnecessary wear.

3. When any bulging of the blocks or other accident occurs which makes necessary the relaying of a portion of the blocks, the work is more easily and accurately done where the bed for the blocks retains its original position and is smooth and hard.

4. A cement-sand bed is good insurance against the displacement of the surface due to water getting underneath the blocks on a grade and shifting a loose sand course. This would apply to springs and leaky service pipes or mains as well as storm water.

5. Wood blocks are usually laid with a

soft filler in the joints. The jamming action of heavily loaded vehicles may easily displace some of the blocks, the sand cushion shifting and retaining the displacement, and the pavement gradually becoming slightly uneven.

SMOOTH SURFACE IMPERATIVE

The writer has seen the results of the failure of plain sand cushion in all of the cases cited. Fortunately, wood blocks accommodate themselves readily to slight displacements and broom down, wearing smooth with the surrounding pavement. To insure long life and even wear, however, it is absolutely essential that the wood blocks should be placed and maintained to as true and even grade and crown as it is possible to get. If the surface is kept true there is practically no wear on the blocks.

The term "cushion," where cement is used, is, of course, a misnomer. It should be called leveling course or laying bed. The blocks themselves are a cushion. Probably the best way to lay wood blocks is in asphaltic cement mopped on an absolutely smooth floated concrete foundation. Such a base, however, is very difficult to obtain in the present state of municipal contracting and a cement-sand bedding course accomplishes very nearly the same results except for the waterproofing of the under side of the blocks.

BEDDING THE BLOCKS

The cement and sand should be mixed dry in the proportions of about 1 to 4, spread on the foundation, templated and the blocks set and rolled in the same manner as where a plain sand cushion is used. This allows the blocks to be properly bedded before the cement has set and avoids any difficulty in placing them on a wet mortar. After the blocks are rolled, the water necessary for the cement can be added by sprinkling the surface of the pavement, or enough moisture would probably be absorbed from the concrete foundation to set the cement. The bedding course should be only thick enough to level up the unevenness in the base, and with ordinary care in laying the concrete foundation, ½ in. should be sufficient. The increase in cost of such a cement-sand course over plain sand is so slight, while the advantages gained are so important to the wearing surface, that continuing the use of plain sand as a bed for wood-block paving appears to be poor economy.

GROSS OPERATING REVENUES FOR FEBRUARY on the large steam railroads of the United States, according to a bulletin issued by the Bureau of Railway Economics, were $897 per mile, showing a decrease of $17 or 1.9 per cent as compared with February, 1914. Operating expenses were $678, a decrease of $68 or 9.1 per cent. Net operating revenues, therefore, were $219—an increase of $51 or 30.3 per cent, and operating income was $171—an increase of $52 or 44.3 per cent. February, 1914, was an abnormally poor month, however, and the net returns for the corresponding months in 1913, 1912 and 1911 all exceeded those for February, 1915. The operating ratio for February, 1915, was 75.6 per cent, as compared with 81.6 per cent for February, 1914, and 75.1, 75.1 and 75.6 per cent for the corresponding months in 1913, 1912 and 1911. The high ratio in 1914 is chargeable to the Eastern district, where it mounted to 88.9.

Arched Reinforced-Concrete Conduits Designed by the Theory of Least Work

Complete Solution for a Large Conduit Subjected to High Earth Pressure by Use of Graphical Methods and Tabular Computation

By WALTER M. SMITH, C. E.
Assistant Engineer, Morgan Engineering Company, Dayton, Ohio

A METHOD of determining the true pressure line in a masonry arch by the method of least work was described by the writer in the Engineering Record of Oct. 10, 1914, page 401. This method is simple when applied to the arch, but becomes much more complex when applied to the entire section of a masonry conduit. The theory is the same, but the difficulty in carrying the pressure line entirely around the conduit and having it check at the crown is very great, and the process would hardly be feasible but for the fact that it can be checked at four points by the position of the resultant forces.

This method is now being used by the writer in designing arched conduits through large earth dams on work being done by the Morgan Engineering Company in the preparation of flood-prevention plans for the Dayton Citizens Relief Commission. The load on some of them will be almost 100 ft. of earth fill over the crown. The largest conduit, if a single one be used, will be about 37 ft. high and about the same width, and would allow three railroad trains to pass through it abreast. This conduit may have to be constructed on a gravel foundation. Under these conditions it becomes imperative to have an accurate method of designing the section.

NOMENCLATURE AND FUNDAMENTAL EQUATION

In an arched structure in equilibrium under the action of external loads, let M = bending moment at any assumed joint, in foot pounds; W, total work of resistance in structure; P, total pressure on section, in pounds; P_n, total pressure normal to section at any assumed joint; P_t, total shearing stress in any joint; C, distance from support measured along axis of arch, in feet; L, length of arch measured along axis; E, modulus of elasticity of material of arch, in pounds per square foot; A, area of section, in square feet, at any assumed joint where P acts; I, moment of inertia of section, in feet, at any joint where P acts, and e, distance, in feet, of point of application of P from center of section at any assumed joint.

The formula for the work of resistance in the arch is

$$W = \int_0^L \frac{M^2 dC}{2EI} + \int_0^L \frac{P_n^2 dC}{2AE} \qquad (1)$$

It is assumed that as only a comparison of values of work is desired, the value of I will be the moment of inertia of the rectangle at the section cut, whether the arch be reinforced or plain, as the steel in a reinforced arch is considered as taking the place of a certain amount of concrete area. Also, the expression for the total work in equation 1 does not represent the entire amount of work, as a small amount is done by the tangential component of the force acting at each joint. However, this portion is so small that unless the pressure line is extremely different in shape from the center line of the arch it will have no effect in the comparison of the values of work for the different conditions.

Substituting b and h for the width and depth of the section at the various assumed joints and taking a strip of the arch 1 ft. long, thus making b = unity, equation 1 becomes

$$W = \int_0^L \frac{M^2 dC}{2E\ h^3/12} + \int_0^L \frac{P_n^2 dC}{2Eh} \qquad (2)$$

The object is now to get a minimum value for this equation, which may be done by trial. It is evident that we can first eliminate from the equation all quantities that remain constant throughout the trials, as we desire only comparative and not actual values. We will therefore eliminate $2E$, and as M is equal to $P_n e$, the equation becomes

$$W = \int_0^L \frac{P_n^2 e^2 dC}{h^3/12} + \int_0^L \frac{P_n^2 dC}{h} \qquad (3)$$

This is the form in which the equation is used, except that the assumption is made that if we divide the arch up so that dC, the distance between assumed joints, is constant, we may use the summation instead of the actual integral without appreciable error in the comparative values desired. The equation in its final form, therefore, is

$$W = \sum \frac{P_n^2 e^2}{h^3/12} + \sum \frac{P_n^2}{h} \qquad (4)$$

h, P_n and e being obtained for each joint in turn and substituted in the equation, and the sum taken for the entire structure.

GRAPHICAL SOLUTION

If there is no reason for having the conduit of any certain shape, but only of a required area, it is best first to draw up a preliminary section and run a pressure line through the center of the crown for the loading given. This will allow an approximation to the economical shape of the conduit. When it is desired to keep the pressure line within the middle third of a masonry conduit without reinforcement, the section will have to be roughly elliptical. If, however, it is desired to have the conduit of the usual shape as shown in the accompanying figures, an approximate design will have to be made and the true pressure line for the entire conduit obtained. Modifications can then be made in the design as indicated by the results obtained with this approximate design, either by changing the shape, changing the thickness, or putting in reinforcing steel where needed.

To obtain the pressure line as mentioned above, the procedure is as follows: Having drawn a sketch of a section of the arch and obtained all the external loads, the force polygon for the entire arch is drawn to any convenient scale. The direction of the thrust at the crown of the arch and at the invert is then obtained by drawing a line between the two points a and p in the force polygon, Fig. 2. This, however, only gives the direction, and not the amount or the

point of application of this force. To obtain these two unknown quantities resort is had to the theory of least work.

The theory of least work is based on the assumption that no structure will do more work than is necessary to sustain the load resting on it. Therefore, in equation 4, if a value for internal work W which is a minimum for the conduit for the load in question can be obtained, the pressure line giving that value is the true one for the conduit. The stresses due to bending moment and the direct stresses at all the joints can then be found and reinforcing steel provided as required.

Example of Design of Conduit

The conduit shown in Fig. 1 with the loads there indicated will be used as an example. It is assumed that the earth surface above the conduit is not level, but sloping; therefore the conduit is not symmetrically loaded, and the crown thrust is not horizontal. Divide the arch up into sections of equal lengths as shown. After all the loads have been found, construct the force polygon for these loads to some convenient scale, as shown in Fig. 2, first without the interior rays. It is better to construct this polygon by rectangular instead of polar co-ordinates, as it can be done much more accurately. If no mistake has been made the polygon will be a closed figure.

After completing the force polygon get the direction of the crown thrust by connecting the point a with the point p, as this is the resultant of all the forces acting on either half of the structure. By connecting the point a with points k and u, obtain the amount and direction of the resultant force on the two halves of the arch, and by connecting the point p with the points k and u, obtain the amount and direction of the resultant forces on the two halves of the invert.

The points of application of these resultants on the arch and invert can then be obtained by assuming any convenient point, taking the sum of the moments of all the forces entering into this resultant, and dividing the sum by the resultant. Now draw a circle through the point with the radius thus obtained, and draw a line tangent to this circle parallel to the resultant in question in the force polygon. This will give the point of application of the resultant on the arch or invert. Repeat this operation for each of the four resultants, and draw them in position on the structure, as they will be needed in checking up the pressure lines.

A line drawn from the point u to the point k in the force polygon will be the resultant of all the forces on the arch and also all those on the invert. The resultants on the structure may then be checked as follows: Prolong R and R_3 until they intersect at k', and R_1 and R_2 until they also intersect at u'. Join k' with u' and a' with p' in Fig. 1. These lines will be parallel with ku and ap in the force polygon, if no mistake has been made.

Locating the True Pressure Line

After getting all these points to check the true pressure line may be located by the method of least work. Take any point, θ, on the line in the force polygon joining the points a and p and draw rays to the points b, c, d, etc. The portion of the line θa will be the crown thrust of the arch, and the portion θp the crown thrust of the invert. Apply this crown thrust at several points on the crown joint, shown in Fig. 1 as Nos. 1, 2, 3 and 4, and prolong in each direction to intersect with R and R_3. Draw lines from the intersections with R parallel with the line θk in the force polygon to intersections with R_1. These lines are the resultants of the crown thrust and R. Draw lines from these intersections parallel to the line ap in the force polygon, to intersections with R_2. These lines are the resultants of the crown thrust, R and R_1. Draw lines from these intersections parallel to the line θu in the force polygon. These lines are the resultants of the crown thrust, R, R_1 and R_2, and if there has been no error will intersect R_3 at the same points as the crown

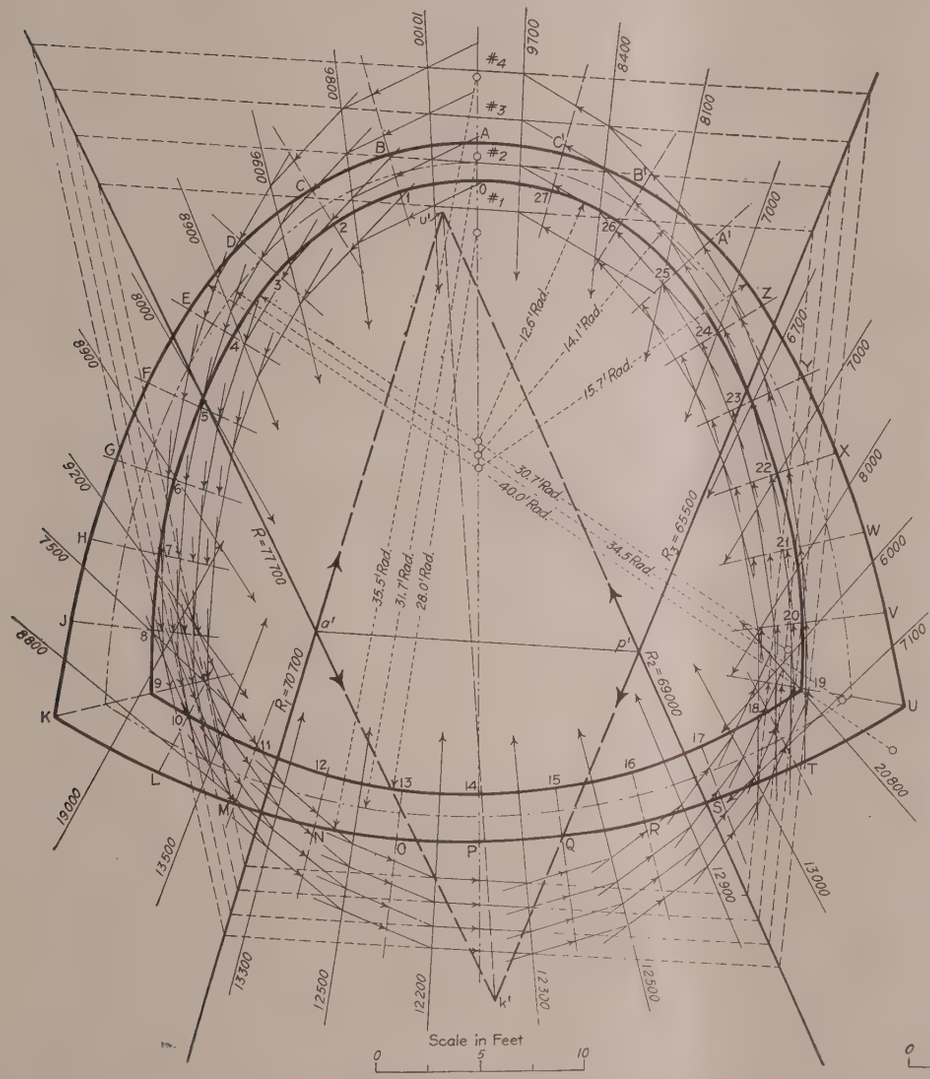


Fig. 1—Trial Pressure Lines

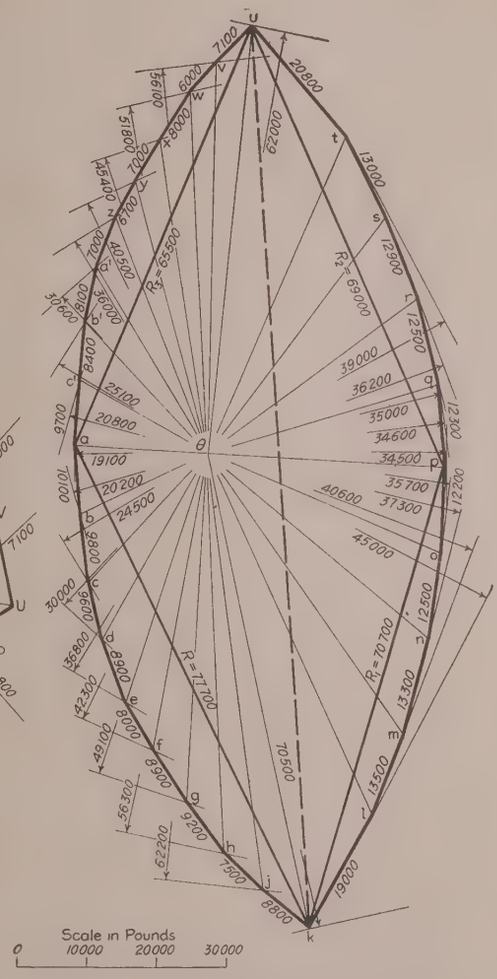


Fig. 2—Force Polygon

ASSUMED LOADS, DIMENSIONS OF SECTION OF CONDUIT, AND GRAPHICAL CONSTRUCTION OF TRIAL PRESSURE LINES

TABLE 1—COMPUTATIONS FOR AMOUNT OF WORK FOR VARIOUS POSITIONS OF CROWN THRUST

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
No. of Joint	h	$h^3/12$	$\frac{Pn}{1000}$	$\left(\frac{Pn}{1000}\right)^2$	$\frac{\left(\frac{Pn}{1000}\right)^2}{h}$ (Col. 5 ÷ Col. 2)	$\frac{\left(\frac{Pn}{1000}\right)^2}{h^3/12}$ (Col. 5 ÷ Col. 3)	e_1	e_1^2	Col. 7 × Col. 9	e_2	e_2^2	Col. 7 × Col. 12	e_3	e_3^2	Col. 7 × Col. 15	e_4	e_4^2	Col. 7 × Col. 18
0	1.80	0.48	19.1	365	202	751	2.30	5.30	3,900	0.00	0.00	0	2.20	4.83	3,620	4.40	19.40	14,580
1	1.85	0.53	20.2	464	250	876	2.25	5.01	4,380	0.25	0.06	52	1.90	2.61	3,160	3.90	15.20	13,300
							The figures for joints 2-25 inclusive have been omitted.											
26	2.00	0.67	25.1	630	315	940	3.00	9.00	8,450	1.30	1.69	1,590	0.30	0.09	85	1.95	3.80	3,565
27	1.85	0.53	20.8	433	234	812	2.60	6.75	5,470	0.60	0.36	1,292	1.50	2.25	1,827	3.45	11.90	9,660
Totals...					16,558				248,945 16,558			181,162 16,558			184,299 16,558			261,692 16,558
									265,503			197,720			200,857			278,250

thrusts extended back previously from the crown joint.

The reason for obtaining these lines on the four sides of the structure is to check upon them when the various pressure lines are drawn, as it would be practically impossible to draw a pressure line through all the twenty-eight joints of this structure and check upon returning to the starting point; but by having these four lines to check upon at intermediate points this can be done.

The next object is to obtain the amount and point of application of the crown thrust that will give the minimum amount of work. First draw lines through the points *a, b, c,* etc., on the force polygon, Fig. 2, parallel to the joints at A0, B1, C2, etc., Fig. 1, and draw lines from the point θ perpendicular to these lines. The length of these perpendicular lines measured to the scale of the force polygon will give the normal force P_n at each joint.

Next draw the pressure lines for the four crown thrusts as shown, checking them up with the resultants on joints K9, P14, U19, and at the crown. Measure the distance *e* from the center of the section to the point of intersection of the thrust at each joint.

TABULAR FORM OF COMPUTATION

It will generally be found convenient to divide *P* by some number, as 1000, in order not to have unwieldy numbers, as the comparative values will not be affected. A convenient form of tabulation for the computations is shown in Table 1. The headings explain the columns. The quantities in columns 1, 2 and 3 remain the same for all investigations, and those in 4, 5, 6 and 7 remain the same for a complete investigation using the same crown thrust in different positions. After the value of e^2 has been obtained for each of the crown thrusts for all of the joints, the value at each joint is to be multiplied by the corresponding value in column 7 for the same joint. When the values in column 6 are combined with those in columns 10, 13, 16 and 19 in turn, we get the comparative values of work for this crown thrust in various positions.

Plot these values on a piece of cross-section paper with the work as ordinates and the points of application above or below the center of the joint as abscissas, as shown in the upper diagram on Fig. 6. Draw a curve through the points. If it passes through a minimum value the computations

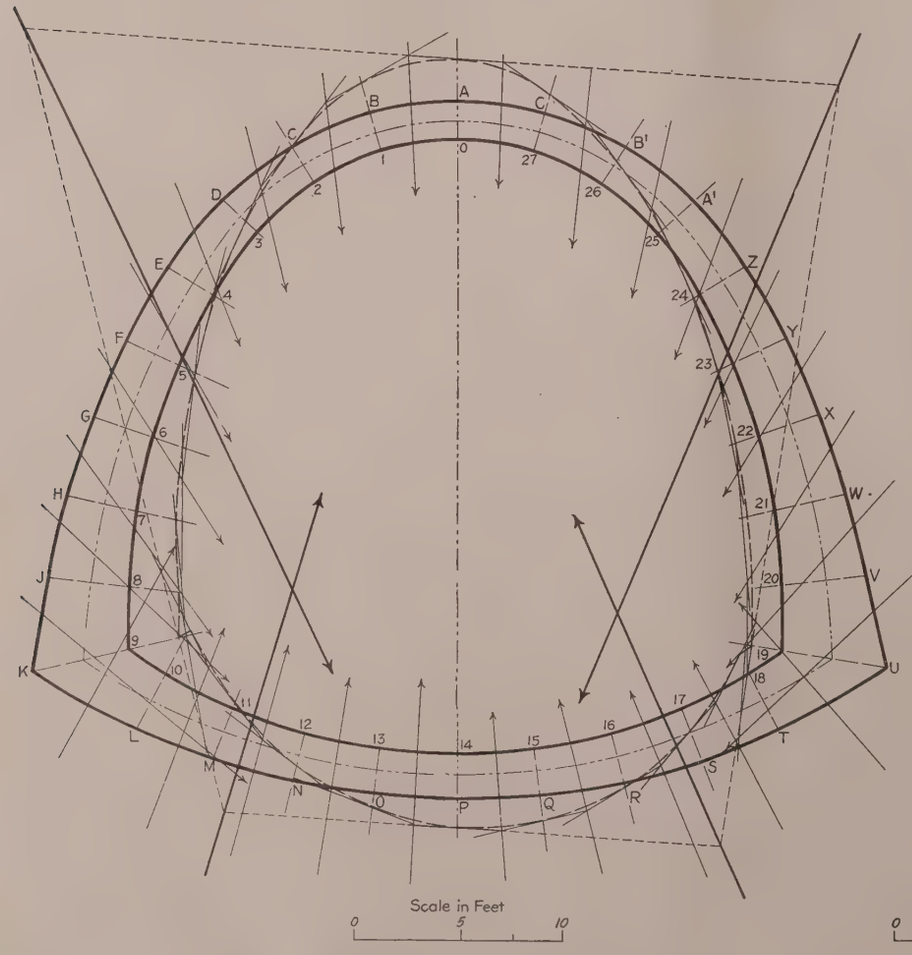


Fig. 3—True Pressure Line

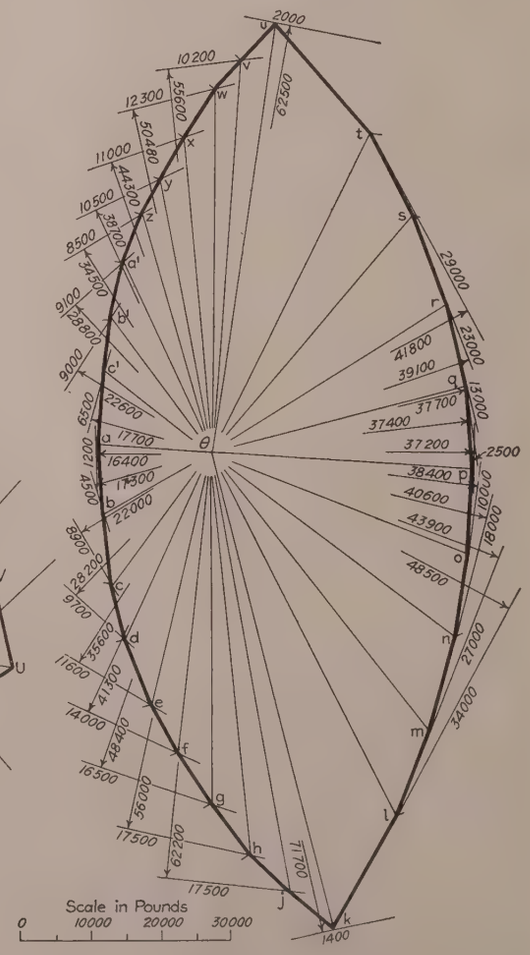


Fig. 4—Force Polygon

METHOD FOR GRAPHICAL CONSTRUCTION OF FINAL POSITION OF TRUE PRESSURE LINE ON CONDUIT

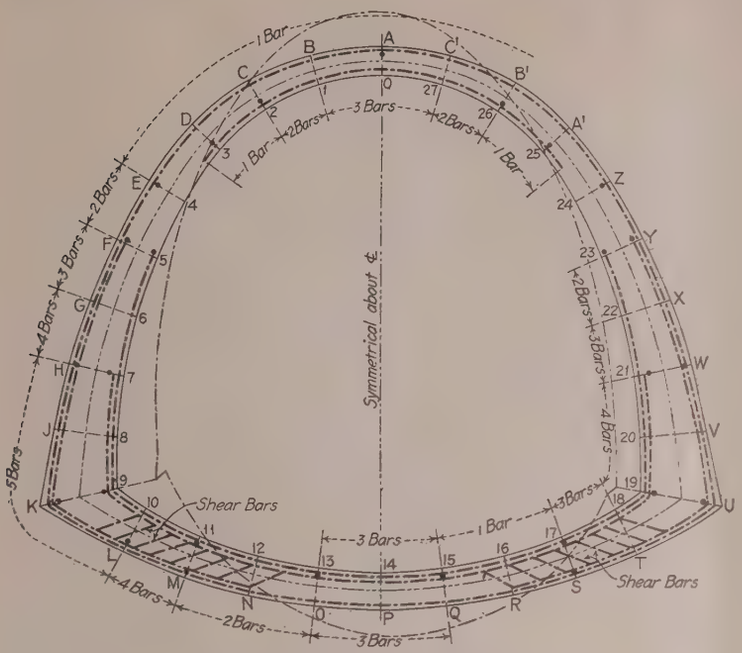


Fig. 5—Position of Steel Reinforcement

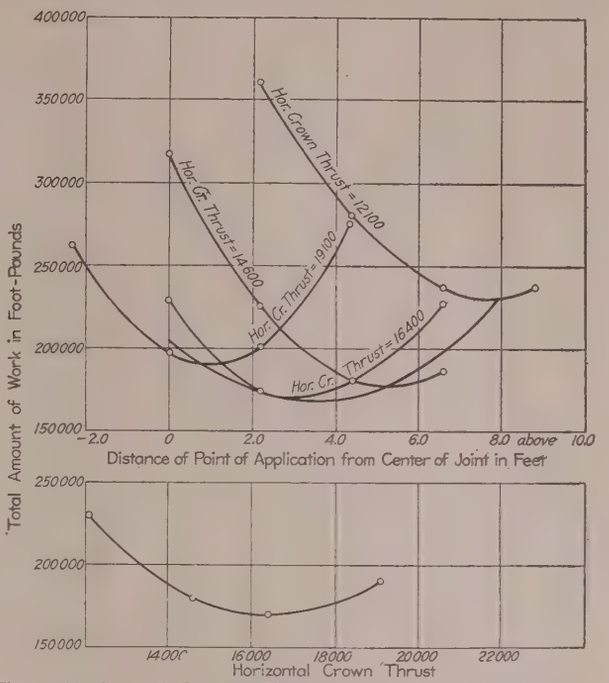

Hor. Crown Thrust = 12100
Hor. Cr. Thrust = 14600
Hor. Cr. Thrust = 9100
Hor. Cr. Thrust = 16400
Total Amount of Work in Foot-Pounds
Distance of Point of Application from Center of Joint in Feet
Horizontal Crown Thrust

Fig. 6—Horizontal Crown Thrust and Point of Application

LOCATION OF STEEL REINFORCEMENT—METHOD OF DETERMINING TRUE CROWN THRUST FOR MINIMUM WORK

for this crown thrust need be carried no further, as a minimum value of work for it is obtained by taking the lowest point on the curve. If the curve does not pass through a minimum value, however, additional points above or below will have to be taken, and the same process repeated until a minimum value has been obtained.

Repeat this process by taking a different point for 0, thus obtaining a new crown thrust, drawing new rays and obtaining new values of P_n in the force polygon. Draw new pressure lines with the new crown thrust placed in the same positions as before and in additional positions, if necessary, until upon plotting the resulting values in Fig. 6 the curve passes through a minimum value. Before drawing these pressure lines the resultants on the four sides should be drawn to check upon, as in the first case.

This process must be repeated to obtain a sufficient number of curves so that when another curve is drawn through their lowest points it will pass through a minimum value. Four trials were needed in this case, as will be seen by reference to the upper part of Fig. 6. Taking the minimum point on the curve will give the point of application of the thrust that will give the minimum amount of work, but will not give the amount of the thrust.

Obtaining the Crown Thrust

Now taking the lower diagram in Fig. 6, using work as ordinates and horizontal components of crown thrusts as abscissas, plot the minimum amount of work for the horizontal components of each of the crown thrusts as given in the upper diagram, and draw a curve through these points. The lowest point on this curve will give the horizontal component of the crown thrust giving the minimum amount of work and will also give the amount of work.

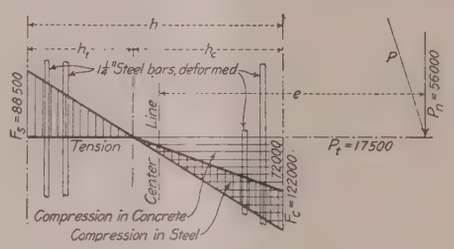


FIG. 7—STRESSES AT JOINT H7

As the direction, point of application and amount of the crown thrust giving the least work have now been obtained, as the thrust has to be parallel to the line ap in the force polygon, draw the force polygon for this thrust as shown in Fig. 4, obtain the new values of P_n and e, draw the true pressure line on the arch as shown in Fig. 3, and compute the stresses in the various joints. In the force polygon constructed for the true crown thrust, obtain P_n by measuring the line from 0 drawn perpendicular to the direction of the joint, and obtain P_t by measuring the distance from the point where this line cuts the joint line to the end of the ray in the force polygon. These two forces are the desired values of the normal and tangential components of the ray P in the force polygon acting on the joint.

It is a good idea to check the foregoing values by computing the work for this true pressure line, and comparing the results with the amount of work shown for this crown thrust in the diagram, Fig. 6. If the two check, the computations are correct; if not, there is a mistake in some portion of the work.

Computing Stresses and Amount of Steel Required

In Table 2 the extreme fiber stresses in the various joints caused by the normal component P_n have been obtained by the formulas

$$F_c = \frac{P_n}{h}\left(1+\frac{6e}{h}\right) \text{ and } F_s = \frac{P_n}{h}\left(1-\frac{6e}{h}\right)$$

F_c being the extreme fiber stress on the compression side and F_s that on the tension side. The total amount of tensile and compressive stress in any joint may then be found as shown in Fig. 7, which is a sketch of joint H7. As the extreme fiber stress at each edge of the joint is known, the values of h_t and h_c can be found by similar triangles. Thus $h_t = h - h_c = h_c F_s/F_c$, and by solving for h_c there is obtained $h_c = h/(F_s/F_c + 1)$. In like manner $h_t = h/(F_c/F_s + 1)$. Having obtained h_t and

TABLE 2—COMPUTATIONS OF TENSION AND COMPRESSION AND AMOUNT OF STEEL REQUIRED

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
No. of Joint	h	$I=\frac{bh^3}{12}$	P_n	$\frac{P_n}{h}$	e	$\frac{6e}{h}$	$\frac{P_n}{h}\left(1+\frac{6e}{h}\right)=F_c$	$\frac{P_n}{h}\left(1-\frac{6e}{h}\right)=F_s$	P_t	$\frac{P_t}{h/144}$	$\frac{F_s}{F_c}$	$\frac{F_c}{F_s}$	$\frac{h_t=h}{\frac{F_c}{F_s}+1}$	$\frac{h_c=h}{\frac{F_s}{F_c}+1}$	Total tension $=\frac{F_s h_t}{2}$	Total compression $=\frac{F_c h_c}{2}$	Value of conc. in comp. $=h_c\times 36{,}000$	Amt. of comp. carried by steel 17-18	Amt. of steel required in comp.	Amt. of steel required in tens.	Amt. of steel required in shear
																			Square Inches		
0	1.80	0.48	16 400	9 120	3.00	10.0	100,300	−82,000	1,200	4	0.82	1.22	0.81	0.99	−33,200	49,600	35,600	14,000	1.17	2 77	
1	1.85	0 53	17,300	9,270	2.50	8.1	84,200	−65,800	4,500	17	0.78	1.28	0.81	1.04	−26.650	43,700	37,400	6,300	0 53	2.22	
2	2.00	0.67	22,000	11,000	1.00	3.0	44,000	−22.000	8,900	30	0 50	2.00	0.67	1.33	− 7,380	29,250	47,800	0	0.00	0.62	
3	2.20	0.86	28,200	12,800	0 40	1 1	26,900	− 1,280	9,700	32	0 05	21 00	1.05	2.10	− 54	28,200	75,600	0	0.00	0.00	

h_c, the total tension is $h_t F_s/2$ and the total compression is $h_c F_c/2$. The value of the concrete in tension is neglected, in shear it is, say, 40 lb., and in compression, say, 500 lb. per square inch, or 72,000 lb. per square foot. The total value of the concrete in compression will then be 36,000 h_c. Deducting this amount from the total compression will give the amount of compression that will have to be carried by steel.

It will be found very convenient to arrange the computations as shown in Table 2, which is self-explanatory. After the values in all the columns up to 19 have been obtained, deduct the values in column 18 from those in column 17 to obtain the amount of compressive stress in each joint that will have to be carried by steel, column 19. If it is thought desirable to have no cracks in the concrete the steel should not be stressed over 12,000 lb. per square inch. Dividing the values in column 16 by 12,000 will give, in square inches, the amount of steel required in tension in each joint. Dividing the values given in column 19 by 12,000 will give in square inches the amount of steel needed in compression in each joint.

Placing Steel Reinforcement

A section of the conduit can now be drawn as shown in Fig. 5, which gives the details of the distribution of the 1¼-in. deformed bars used in this design. In a large conduit under very heavy loading and with very high stresses it will be best to use the largest possible deformed bars in order not to cause any unnecessary trouble in thoroughly bonding the concrete. The manner of placing these bars where heavy reinforcement is necessary is shown in Fig. 7. At this joint so many bars are needed that if they were placed in the same plane they would be too close for the concrete to bond well between them. The bars may be bent into hooks at the ends when the additional length is needed to develop the strength of the bar. Otherwise it is best to leave off the hooks.

Theoretically, the center of gravity of the reinforcement on both the tension and compression sides should coincide with the center of gravity of the stress diagram. This is manifestly impossible, however, as the centers of gravity of the stress diagrams are in different positions at every joint. The steel reinforcement is generally made symmetrical about the center line, suiting it to the worst joint in each case, but if a material saving can be made by making it unsymmetrical there is no objection to doing so. Sufficient longitudinal reinforcement should be used to hold the other reinforcement securely in position when wired together.

If Table 2 were completed it would be seen that there are only five joints where there is more shear in the joint than the concrete can stand, but for the sake of symmetry it is best to put shear bars to take the excess in the six symmetrical joints L10, M11, N12, R16, S17 and T18, as shown in Fig. 5.

In conclusion it may be stated that, although this method undoubtedly requires considerable time for its application, it is the best method known to the writer for making an accurate analysis for this type of construction.

The question might be asked whether the additional moment of inertia given by the steel bars at the various assumed joints would not render the foregoing determination of the pressure line inaccurate and make it necessary to go through the entire process a second time with the steel in position. The amount of steel in the joint does not affect the determination of the pressure line in the least, but does, of course, affect the total amount of work materially. The reason for this is readily seen. To determine the true pressure line, only relative values of work are desired, so that a minimum may be obtained. The same moment of inertia at each joint is used in the entire series of computations, so that any increase or decrease in this moment of inertia does not affect the comparative results.

In order to determine what effect the steel in the conduit would have on the amount of work, one set of five pressure lines with the same force polygon as for the plain concrete section was computed. It was found that the total amount of work for each of the pressure lines was just 70 per cent of the corresponding value for the plain concrete arch. Therefore the crown thrust which gives the true pressure line for the minimum amount of work remains the same, and it is unnecessary to include the effect of steel in the determination of this true pressure line.

New Power Plant Has Highest Head in New England

Energy Available in 480-Foot Fall Between Storage Reservoirs Was Hitherto Unused, Though Lower Basin Fed Waterwheels

In 1905 a hydroelectric plant of 1200-kw capacity was erected at Chittenden, Vt. It obtained its water from the East Pittsford Reservoir, which, in turn, was fed from the Chittenden Reservoir, about 3 miles upstream. Though the difference in the spillway elevations of the two basins is more than 480 ft., no attempt was made to utilize the power available. In 1914, however, work was started with a view to the utilization of this wasted power.

The logical location of the power station was, of course, at as near the elevation of the lower reservoir as possible. A suitable site was found between stations 161 and 162 measuring from the outlet of the upper dam. This gave a difference in elevation of 487 ft. between the bottom of the tailrace and the spillway of the Chittenden Reservoir.

Wood-stave pipe, 60 in. in diameter, was used for the penstock up to a point about 2700 ft. east of the power house. The drop in grade in the last 2700 ft. being very abrupt, steel pipe was used in this section. A standpipe, 24 in. in diameter and 55 ft. high, was placed just below the intake valve to prevent collapse when emptying the penstock. This was protected by a double frost casing of wood staves, and provision was made for electric heating.

The staves for the first 1400 ft. were cut near the site. The timber was sawed into 3 x 8 and 3 x 6-in. stock and air dried for about nine months. The staves were made 2⅝ in. thick and, as there were three times as many 8-in. as 6-in. pieces on hand, they were milled so that it took twenty-one of the wide stock and seven of the narrow to make a section of pipe. Though this is a deviation from the usual practice of having all staves uniform, no very serious delay was occasioned in erection.

Near the point where the wood-stave penstock is joined to the steel line a surge tank, 14 ft. in diameter and 90 ft. high, was built, the top of it being 19 ft. higher

GENERAL LAYOUT OF NEW HYDROELECTRIC DEVELOPMENT AT CHITTENDEN

Wood-stave pipe used where gradient permitted; steel pipe used on last 2700 ft. of line on account of abrupt drop in grade

FROST CASING PROTECTS SURGE TANK

than the flashboards at the upper dam. A frost casing was built 4 ft. larger in diameter than the tank itself. Old 2-in. planks, butted off square and held in place by iron bands spaced 2 ft. apart, were used for this purpose. As a protection against fire and decay, the casing was plastered with cement mortar on wire lath.

The first 600 ft. of steel pipe is 54 in. in diameter, and the remainder, down to the power house, is 52 in. in diameter. To protect the line against undue rise of pressure caused by the action of the governor under the varying conditions of load, a relief valve capable of discharging 30 cu. ft. per second was installed. Just outside the power house there was inserted in the line a 52-in. Venturi meter.

In the power house, three 24-in. lines head off the penstock to the turbines. The turbines are placed directly over the tailrace and are carried on I-beams. Space is provided for three units, although only two have been installed. The turbines are of the single-runner Francis type, built by the Morgan Smith Company, each developing 1850 hp at 720 r.p.m. under a 430-ft. head at full-gate opening. The wicket gates are controlled by a Lombard governor of the direct-connected type, arranged for electric control. The draft-tube is about 14 ft. long and has a diameter of 48 in. at its lower end.

The station is designed for an ultimate continuous capacity of 3000 kw at 44,000 volts, this energy to be generated by three units and delivered through two 44,000-volt feeders, designed for a maximum capacity of 3000 kw at 4400 volts and 80 per cent power factor.

The plant, owned by the Pittsford Power Company, was designed by and constructed under the supervision of W. S. Barstow & Company, engineers and managers, New York City.

The U. S. BUREAU OF STANDARDS has evolved a remarkable device for accurately indicating very small deflections of a steel bar 3 ft. long and 3½ in. in diameter. This bar is supported at each end and a small mirror is fixed at the center, above which is a frame bearing another partially silvered mirror, both of which reflect the light of a sodium burner, the lower mirror showing a series of black and yellow concentric rings. The slightest pressure on the bar—even the weight of a visiting card or a pin—causes these circles to expand outward, forming as it were a series of ripples like those made when a stone is dropped into the center of a still pond. The pressure of one finger on the bar causes the formation of five or six new circles, showing that the bar has been bent about 1/20,000 in., as each new circle means a 1/100,000-in. movement.

Maximum Use of Industrial Railway Possible at Low Cost

Fred Tarrant, Division Engineer, Illinois Highway Department, Gives His Experience in Building Country Roads

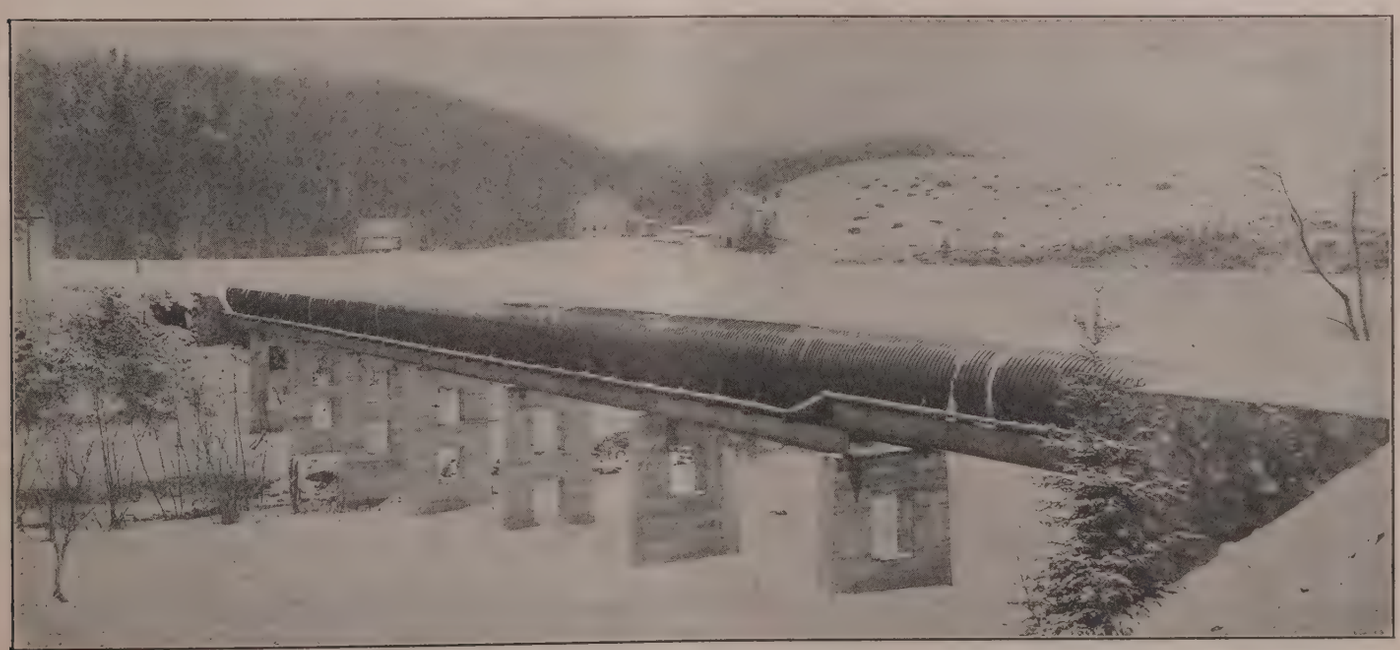
HOW industrial equipment is operated on Illinois highway work to get a maximum use at a low cost is described by Fred Tarrant, division engineer, in the Illinois Highway "Bulletin" for April. The equipment used in the construction of a 12.5-mile waterbound macadam road 10 ft. wide consisted of two 20-hp locomotives, 6 miles of portable track and sixty cars. The rails and ties were made up into 15-ft. sections, each section weighing 225 lb. and capable of being handled by two men. The switch and curved sections were in 15-ft. lengths also, and were easily and quickly fitted into the main track in case a switch or turnout was desired. The steel ties and angle joints were all bolted securely.

Two flat cars were received for use in hauling steel, but Mr. Tarrant found that better results could be obtained by removing the beds from the stone cars and hanging sixteen or eighteen sections on each truck, coupling them together by a 6-ft. pole. Later, when the entire equipment was moved overland to another job, it was a common occurrence to see one of the engines pushing or pulling fifteen to eighteen of these trucks.

TRACK LAYING

A crew of four men was found to work to the best advantage. The amount of track this crew could lay depended largely upon natural conditions. After becoming thoroughly acquainted with the work and knowing how to take advantage of it, an average of 2000 ft. could easily be laid and lined in one day, The track was usually laid the full length of the road and near the side of the prepared subgrade. The construction of the road was started at the far end, and, as the work was completed, the track was pulled up and relaid on the next route, or brought into the yard and stacked in a pile ready for shipment.

In order to keep the track in good align-



WOOD-STAVE PENSTOCK IS CARRIED ACROSS WATERWAY ON SUBSTANTIAL TRESTLE OF CONCRETE PIERS AND STEEL GIRDERS

ment one man was required to go over it continually looking for low joints and loose connections. This is important in case there are any steep grades, since it is absolutely necessary to keep the track in first-class shape in such places. Care in this matter greatly increases the efficiency of the engine. It was often necessary to increase the speed of the engine in order to climb the grade with the load. The train load was made up by placing ten or twelve loaded cars ahead of the engine and from twelve to sixteen loads behind, depending on the grade. Where grades were 4 per cent or over, it was necessary for the train crew to drop the rear end of the train, push the cars in front of the engine to the top of the hill, and then back up for the rear end. This required but little extra time and made it possible to haul 30 to 40 cu. yd. a trip.

The cars were 1000-lb. steel dump, capable of dumping on either side and having a capacity of ½ yd. of material. The dumping of the stone was handled by a brakeman and helper. The train was stopped at the proper place and eight to ten cars tipped over, dumping the stone about the center of the prepared subgrade. After the stone was dumped, the empties were pulled out and the track thrown over on the earth shoulder and realigned. By uniform loading the proper amount of stone was dumped from each car to make the desired thickness of stone in the road.

To increase the length of time that the engine might be out on the line a mule was used for yard switching. The watering plant consisted of a gasoline engine and an elevated tank with coal bins handy, so that coal and water could be taken at the same time, thus minimizing any delay to the engine. A small amount of time wasted on each trip due to poor organization and switching in the yard with the engine soon mounts up, and in the course of a day one or more trips may be lost which would add greatly to the cost of hauling.

Transfer Equipment Overland

Upon the completion of hauling stone for 8.5 miles of the road, the central loading station together with the entire equipment was transferred 6 miles overland to a new station. This was accomplished in six days by picking up the track in the rear and hauling and placing it ahead continuously. In this manner the entire equipment was moved quicker and cheaper than if it had all been picked up and loaded on railroad cars. The movement, including picking up and relaying track to the new location, cost $329.

Weather and Soil No Handicap

Weather conditions had little effect on the hauling, as only two days in the entire season were lost, and that was due to the fact that ¼ mile of the track was laid on low ground and the water was above the rails. The soil was of a heavy black mucky nature and one in which hauling by means of teams or tractors would have been greatly handicapped in wet weather. The only way in which it affected the industrial railway was to make the shifting of the track more difficult than in dry weather.

The equipment was leased for six months. A little less than five months' time was consumed in hauling 25,473 cu. yd. of stone with an average haul of 3.17 miles, which included unloading and reloading of equipment. The cost of hauling the stone on the rental basis, which included all expenses incurred in the hauling as well as freight both ways from Koppel, Pa., was 14.8 cents per ton-mile. The comparative cost of team haul on this particular job was estimated to be 28 to 30 cents per ton-mile, regardless of the fact that it would have been impossible to have secured a sufficient number of teams to have completed the work in a year. In this instance if the township had owned the equipment the cost per ton-mile would have been still lower. Assuming 20 per cent for depreciation, also the necessary repairs to put the equipment in good working condition after use, the cost would have been 11 cents per ton-mile.

In conclusion, Mr. Tarrant states that some of the advantages to be derived from the use of industrial equipment are: Low cost of hauling; quicker hauling; independence of weather conditions; freedom from labor strikes; reduction of number of men on the pay roll; no expense for resurfacing subgrade; minimizing danger in passing over country bridges, due to light weight of equipment; and smallness of space required for operation.

Water Consumed in Milwaukee per capita during 1914 averaged 110.2 gal., a reduction of 1.3 gal. over the previous year. Because of the large number of manufacturing establishments it is practically impossible, according to the last annual report of the waterworks department, to expect a much lower consumption.

Work to Start in Deep Cofferdam for New York Pier

Water Has Been Lowered in Six Weeks as Far as Feasible at 1000-Foot Pier at Forty-sixth Street, Manhattan

On MAY 10 the water level in the 800-ft. cofferdam for constructing the shore end of the Forty-sixth Street municipal pier, Manhattan Island, New York, had been lowered to 35 ft. below mean low tide. This is as low as it can be pumped until work is started on the rock excavation and a permanent sump constructed. The deepest excavation in the cofferdam will be about 44 ft. below mean low tide, giving a maximum possible head on the coffer at high tide of 51 ft.

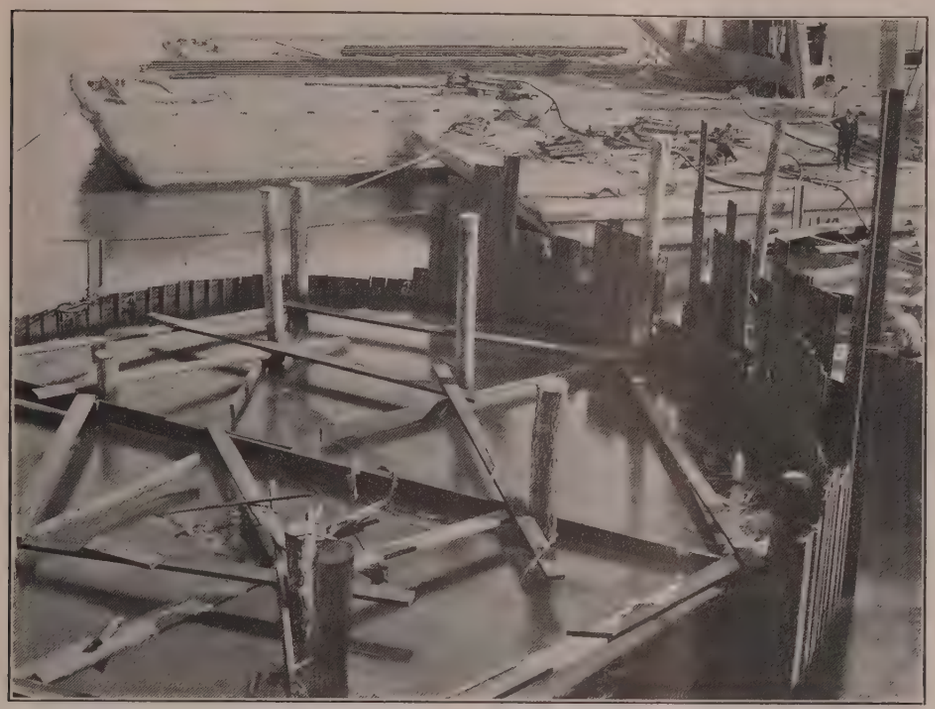
As noted in the "News of the Week" of the Engineering Record of April 10, page 475, pumping was begun March 29 with a 10-in. centrifugal steam pump, mounted on skids on the stone banking near the middle of the river arm of the cofferdam. These skids, to which the pump platform was bolted, were slid down the steep slope twice as the pumping proceeded to keep the pump suction close to the water level. The lowering was done with tackles attached to the tops of the cofferdam sheet piles, and the skids were tied up to the same anchorage with wire rope to hold them from sliding farther. Because the banking is of rock, this arrangement has proved amply solid.

STAGE OF WATER THIRTY FEET BELOW LOW TIDE INSIDE COFFERDAM FOR NEW FORTY-SIXTH STREET PIER

The two cells at the left end of the river arm owe their complete watertightness to the fact that the heavy fill in each, mainly stone, stretches the sheeting until each interlock is pulled tight

The timber float, on which three electrically driven pumps were mounted, is now landed at the south end of the river arm of the coffer. Its suctions, which were originally dropped over the river side of the float, have been extended over the north side, and are already nearly out of water.

Several leaks developed during the pumping, but all have been nearly stopped. This was done by filling outside the leaks with fine clay from a cellar excavation near the pier and with sawdust, by driving down the single walls of sheeting at the shore ends of the upper and lower arms, and by compacting the ground at one place by driving, pulling and redriving round piles. The entire leakage encountered is much less than the leakage in any lock cofferdam constructed on the Ohio River in recent years. These lock cofferdams are slightly larger in plan than that at the Forty-sixth street pier, but generally withstand a much smaller head. No accurate measurements



STEEL FOR ONE OF THE HUGE CYLINDERS AT LOWER CORNER SET AROUND TEMPLATE

These cylinders stand without banking. Space was limited by an adjacent pier at this corner, and the stone-banked construction, using a core of steel sheet-pile cells, could not be used

have been taken, but as the leakage is easily held by the 10-in. pump running days, and one of the 6-in. pumps running at night, it must be considerably less than 1000 gal. per minute, which is considered extraordinary in what is said to be the deepest unbraced cofferdam ever pumped.

Locomotive Cranes to Handle Spoil

The water is now low enough to permit work, and six tracks, at an elevation of a few feet above high tide, will be thrown across the cofferdam at right angles to the river arm to carry the cranes and dinkies, which will handle spoil from the rock excavation for the new slips. The construction of several of these tracks has begun. These tracks will be gathered into a double-track line on the river arm of the cofferdam, from which a double-track branch will run to the end of the old Forty-fifth Street pier, which is still standing in the river. Here the spoil will be dumped in scows. A driver boat is now building the trestle to connect the old pier end to the coffer.

The work is being done by the Holbrook, Cabot & Rollins Corporation for the Department of Docks and Ferries of New York City, of which R. A. C. Smith is commissioner, R. C. Harrison, first deputy commissioner and C. W. Staniford, chief engineer. Thomas D. Bryson is in general charge for the contractors, and Daniel Hughes is superintendent on the work.

Bacteria in the Water of Columbus, Ohio, during 1914 averaged 6331 per cubic centimeter in the raw water and 14 in the filtered water. Beginning in 1909 the bacterial content of the filter plant effluent for five years was 120, 24, 55, 14 and 15, according to the annual report of Charles P. Hoover, chemist in charge of the purification plant.

Bureau of Standards on the Autoclave Test

Abstract of Technologic Paper 47, Which Discusses the High-Pressure Steam Test of Portland Cement

By R. J. WIG and H. A. DAVIS
Of the Bureau of Standards

THE use of high-pressure steam as a means of determining the soundness and cementing quality of Portland cement was advocated as early as 1880 by both Michaelis and Erdmenger. It has been recommended and used by others from time to time until recently when a form of this test was advocated and introduced into specifications for the purchase of Portland cement as the Force Autoclave Test. [See Engineering Record, July 5, 1913, pages 1 and 13 to 19. For autoclave patent situation, see Engineering Record of May 16, 1914, pages 547 and 550.] Many brands of American cement would not regularly meet the requirements of this test and its recent introduction led to a controversy between cement manufacturers and consumers. The manufacturers of Portland cement contended that this test was an abnormal one and the behavior of a cement when so exposed was no criterion of its ultimate behavior as normally used in concrete. Furthermore, it was suggested that this test be introduced into the United States Government Specification for Portland cement and it was for these reasons that an investigation of the value of the high pressure steam test was undertaken by the Bureau of Standards.

This investigation included a study of the physical properties of cements that were sound after exposure in high-pressure steam and cements that failed to meet the requirements of this test. Tests were made of the tensile and compressive strength in mortars, compressive strength in concretes and the linear change of neat cement prisms stored in air, in water, and treated in high pressure steam.

The Test

The qualitative high-pressure steam test consisted of subjecting a pat of neat cement, after storing for the first 24 hours in a damp closet, to steam at a pressure of 300 lb. per square inch for one hour, the total time in the steam-tight boiler being 3 hours.

TIMBER RAFT CARRIES DOWN THREE ELECTRIC PUMPS

PUMP ON SKIDS SLID DOWN BANK AS WATER RECEDES

METHODS WHICH LOWERED THE PUMPS WITH THE WATER AND SAVED THE EXPENSE OF A SECOND-STAGE INSTALLATION

A cement was said to have passed this test if the pat was hard and sound when examined after this treatment. The quantitative high-pressure steam test consisted of molding six neat cement briquettes, storing them 24 hours in a damp closet, then treating three of them in steam at 300 lb. pressure for one hour in a steam tight boiler, the total time in the boiler being 3 hours. The six briquettes were then broken in a cement testing machine and a cement was said to pass the high-pressure steam test if the treated briquettes showed higher tensile strength than the untreated.

Eighteen two-barrel samples of cement, composed of seven different brands, were obtained for testing in concrete. The cement of some of these samples passed the high pressure steam test and the cement of other samples did not. The concretes prepared from these cements have been normally exposed to the atmosphere for 2 years or more and tested for compressive strength from time to time. Sufficient specimens were prepared to continue the tests for 10 years.

Summary of Results

The following is a brief summary of the results of this investigation.

The general soundness tests show that some cements mixed neat which are sound according to the standard atmospheric steam test but unsound in high-pressure steam exhibit signs of unsoundness when stored under normal conditions in dry air. This unsoundness may require 9 months or more to develop in neat-cement specimens.

The strength tests of mortars and concretes fail to show any difference in the cementing quality of cements that pass the high-pressure steam test and those that fail to meet the requirements of this test.

There is but small difference, if any, in the linear change of prisms made of cement that passes the high-pressure steam test and prisms made of cement that fails to meet the requirements of this test whether stored in air or water.

Seventy per cent of a total number of fifty-one brands of Portland cement tested passed the high-pressure steam test.

Cements normally unsound in the atmospheric or high-pressure steam tests, will generally be found to be more sound than the original cement if the coarser particles are removed. While fineness is not essential to soundness, it appears usually to be the coarse particles of a normally unsound cement that cause the expansive action resulting in cracking and disintegration of the hardened cement in the accelerated tests of soundness.

A cement originally unsound in the high-pressure steam test will usually be found sound if exposed to this test after aging from 2 to 6 months.

Conclusions

The following conclusions are drawn from the results obtained.

1. The high-pressure steam test should be made on all cements that are to be incorporated in cement mortar or concrete products that are to be cured in steam at pressures above atmospheric.

2. The high-pressure steam test may be of value as forecasting the behavior of neat cement or a very rich mortar when exposed under normal conditions in dry air, but it does not forecast the behavior of cements in concrete as normally exposed.

3. Cement passing the high-pressure steam test is not superior in cementing quality, as determined from the compressive strength of concretes, to cement that fails in this test.

4. Cement passing the high-pressure steam test does not make more permanent or durable concrete than cement which meets the requirements of the standard specification but fails in this test.

5. Cement failing to pass the standard specification atmospheric steam test but meeting the other requirements of the standard specifications shows in some instances a normal strength in concrete.

6. For practical work under normal conditions of construction, the results of this investigation fail to show that the high-pressure steam test is of value as a means of determining the ultimate soundness of concrete.

Blanket Versus Cut-Off Wall for Sealing Bank at Cedar River Dam

D. C. Henny Discusses Factors Affecting Cost of Each but Is Prevented from Drawing Final Conclusions by Meagerness of Data

NEWS notes in this journal have, since the first of this year, kept the readers of the Engineering Record informed as to developments in connection with the leakage at the Cedar River dam of the city of Seattle. As far as conditions at the site are concerned there has been little change, the leakage still averaging about 200 sec. ft. The city engineer, A. H. Dimock, on April 27 applied to the City Council for an appropriation of $25,000 to continue studies as to the best method of stopping the leakage. A cut-off wall to rock and an impervious blanket over the porous material have been discussed. With his report, which was a statement of present conditions at the dam, Mr. Dimock transmitted a report by D. C. Henny, consulting engineer, of Portland, Ore., without, however, commenting upon it.

Since the report was rendered the council has ordered that plans and specifications be prepared for silting the pervious bank.

Mr. Henny's report, abstracted below, reviews the two general methods suggested for stopping the leakage—a cut-off wall, and a blanket. Under the latter method he discusses separately blankets of local materials, placed dry and by hydrauli-cking, and of concrete. He does not draw conclusions, since the data at hand when his report was prepared, March 2, were too meager to allow an estimate to be made as to either the extent of the wall or blanket or the cost of the work. In any event the cost is certain to be high. Mr. Henny also discusses the character of the moraine through which the seepage is taking place.

The history of the construction of the dam and the development of the leakage was given in the Engineering Record of Jan. 9, 1915, page 62. Some further details as to the leakage are given by Mr. Henny in the opening of his report, and are reproduced in the accompanying table.

The abstract of that portion of Mr. Henny's report which relates to methods of repair is as follows:

The economical feasibility of constructing a tight diaphragm must depend upon the depth to tight material, although even on the basis of data at present available it is evident that such method must be exceedingly expensive as the length of such diaphragm may be over 7000 ft. and its depth over 180 ft.

Roughly speaking, the excavation of such a trench may involve the moving of from 150,000 to 200,000 cu. yd. of moraine material in connection with a concrete diaphragm, and at least two or three times this amount for a diaphragm built of clay or silt. The total cost of such work would probably be close to $1,000,000, and possibly more. As other methods of stopping seepage, however, will also be very expensive, it will be desirable to continue one or more of the shafts or one of the wells [then under way] down to bedrock.

Seepage Losses at Cedar River Dam

Period 1914	Average water elev. in reservoir	Loss Sec.-ft.	Loss Acre-ft.	Average area submerged, acres	Loss per acre per day, feet	
Nov. 7-10	1,480.5	105	841	11.5	18.2	
Nov. 11-13	1,494	422	2,534	28	30.2	
Nov. 14-19	1,508	261	3,132	46	11.3	Period of variable inflow
Nov. 20-22	1,516.4	186	1,128	64	5.9	
Nov. 23-29	1,521.4	217	3,042	72	6.0	
Nov. 29-Dec. 2	1,521	254	1,522	70.5	7.2	
Dec. 3- 6	1,519.5	156	1,244	68	4.6	
Dec. 7-12	1,508	47.2	567	46.5	2.0	
Dec. 13-17	1,495	26.1	261	26.6	2.0	Period of no inflow
Dec. 18-25	1,485	9.4	151	15.0	1.26	
Dec. 26-Jan. 2	1,475	5.1	81	8.6	1.17	
			14,503			

Blanket

In regard to treating the interior surface of the reservoir, any consideration of this method will require a determination of the probable area to be treated. If it is found that the fine sand beds near the old dam continue down to bedrock, there is some possibility that surface treatment might be confined to about 125 acres. It is more probable, however, that much of the area farther upstream will need treatment and the total area may exceed 200 acres. In rock-filled dam construction a tight coating would probably require a normal thickness equal to the depth of water against it.

It is evident that since the average water depth over about 75 acres will probably be 90 ft. at high water and over 50 acres will be about 50 ft., a thickness of blanket equal to water depth is out of the question, and this method can be considered only if material is available which will be satisfactory with less thickness.

A physical analysis, made during Mr. Henny's visit, of normal bank material shows that while short in fine sand and silt it is otherwise very well graduated, and that although the voids are large their percentage to the mass is relatively small. There are indications that all the treatment which the normal material may require to render it fairly tight is the admixture of a small proportion of sand such as is available in the banks near the old dam.

Should investigation show that with a mixture as above outlined proper seepage reduction could be attained by the use of a blanket, the thickness of which need not exceed an average of one-fifth the water depth against it, there may be required for the treatment of 125 acres of reservoir surface about 3,500,000 cu. yd.

The cost of laying such blanket, using the material at the place and mixing it with fine sand to the extent of, say, 20 per cent, must depend upon the method and special machinery employed. It is very unlikely that an average price of less than 20 cents could be reached. As this process must be preceded by clearing of stumps, it is evident that its cost may be guessed at the present time at from $700,000 to $1,000,000, according to the acreage to be treated, while its feasibility still remains doubtful until percolation tests shall have been made. [Percolation tests on various mixtures of the materials are now under way.]

Placing Blanket Hydraulically

Consideration has been given to sealing the reservoir bottom and sides by the hydraulic process. [See abstract below of letter to Mr. Henny from W. C. Morse, of Lewis, Wiley & Morse, Inc., of Seattle, Wash.] It is highly probable that yard for yard the hydraulic method is likely to be far more economical than the dry method, and it may be noted that Mr. Morse suggests a blanket 6 ft. in thickness, or far less than suggested under the dry method.

The material immediately at hand for hydraulicking is either the bank material itself or else the surface loam on top of the bench, and so far as Mr. Henny's observation had shown the amount of fine silt contained therein is relatively very small, and in case material that will pass through a 100-mesh sieve be considered silt, not exceeding a few per cent. A 6-ft. layer would thus produce only a few inches of fine silt, which, even if it could be laid against the present slopes in a connected sheet, would be entirely insufficient for the purpose.

Possible Results

It is probable, however, that in the application of the method a large proportion of the silt will be carried down into the open voids of the normal banks unless first closed up with fine sand, of which locally the supply seems to be very short. Silty water carried into the open pores of the bank may produce some good, but the probability is that much of the silt so carried in will fail to close the pores and enter to an uncertain depth without producing any material tightening effect.

The manner in which this method may be employed with reasonable hope of success is by accomplishing, by its means, what was aimed at with the dry method, namely, the mixing of fine sand with local bank material. The great difficulty will be to place it in its final position so that a large part of it settles in a thoroughly mixed state free from stratification.

So far as Mr. Henny knows, such result has never been attained, but he thinks that there is some possibility that it may nevertheless be accomplished; at least men of large experience in this line express such opinion. It is readily conceivable that if such method should be found successful and dependable a thinner blanket than was preliminarily suggested for the dry method may answer. It is probable, moreover, that the unit cost of placing material will be much lower, and the entire scheme has therefore attractive features.

Its feasibility will have to be judged by tests and experiments with the various classes of available material, and if found promising in connection with this process it may be desirable to plan a test on a fairly large scale for some selected portion of the reservoir bottom and slope.

Concrete Skin

There yet remains a third method of skin treatment, namely, concreting the interior surface of the reservoir where necessary. One acre of concrete 1 ft. thick contains 1613 cu. yd., and if for present purposes it be assumed that 1 ft. thickness of concrete is sufficient, and that it can be placed at the extremely low price of $4 per cubic yard, one acre would cost $6500, and the total cost, including surface preparation, would again be close to $1,000,000, and might possibly exceed that amount.

Experiments made some years ago on the Umatilla Reclamation Service project show that seepage through 1:3:4 gravel concrete varies per foot of water pressure and per foot of thickness of concrete from 0.009 to 0.005 acre-foot per acre per day. Assuming an average pressure of 70 ft., 1 ft. of concrete might thus be expected to lose about 6 in. of depth per day, which would be equivalent for 125 acres to 31 sec.-ft., and for 200 acres to 50 sec.-ft. It is probable that silting as well as gradual hardening of the concrete would materially reduce this seepage, even with concrete with lower cement content. On the other hand, extra leakage would be likely to develop at cracks and joints.

The bank material according to the single sample analyzed is unusually well graded. By using the material in place it may be that, through the use of special machinery, concrete can be produced at a very low unit cost, so that even if a greater average thickness be considered than 12 in. the total cost may be greatly reduced.

It will also be feasible to consider a concrete, lean as to cement, but otherwise hard and firm, and coating it, before it has set, with mortar applied either in the ordinary manner or with the cement gun. It is known that even a thin layer of mortar may be made practically water tight if properly applied and sufficiently rich in cement.

Tentative Conclusions and Tests

On the whole the hydraulicking and the concreting methods, if material available in place can be used for the bulk of the coating, seem from present indications to offer the best possibilities of lowest cost and least uncertain results. The concrete method will have the advantage over hydraulicking in that if the results as to tightness are not up to expectations additional work can later be more readily done.

The investigations which in Mr. Henny's opinion are essential to acquire an intelligent judgment should be made in the order of their importance along the following lines:

1. Open test pits to determine probable area to be treated.
2. Physical analysis of reservoir bottom and slope materials and determination of rate of percolation.
3. Tests of various mixtures of slope and bottom material with loam and with fine sand, both without and with cement, and determination of rate of percolation.
4. Boring or shaft work to determine depth of bedrock at least at one or two points along most promising line of cut-off wall.

The tests for percolation may be made in suitable tanks in accordance with standard practice and should be arranged so as to show results not only for the usual 3-ft. water head on 3 ft. of test material, but also for heads to not less than 60 ft. and, in case of concrete, for heads to 200 ft.

The figures of cost and possible seepage losses after treatment, herein submitted, are necessarily speculative to a large extent by reason of absence of definite data upon which to base them, and are submitted merely to afford some preliminary and general views on the relative merits of the various solutions of the problem.

Mr. Henny's discussion of the hydraulic method of placing the blanket was based on a letter to him from W. C. Morse, of Lewis, Wiley & Morse, Inc., hydraulic contractors, of Seattle. The following paragraphs from that letter give the suggestions relating to the hydraulic method:

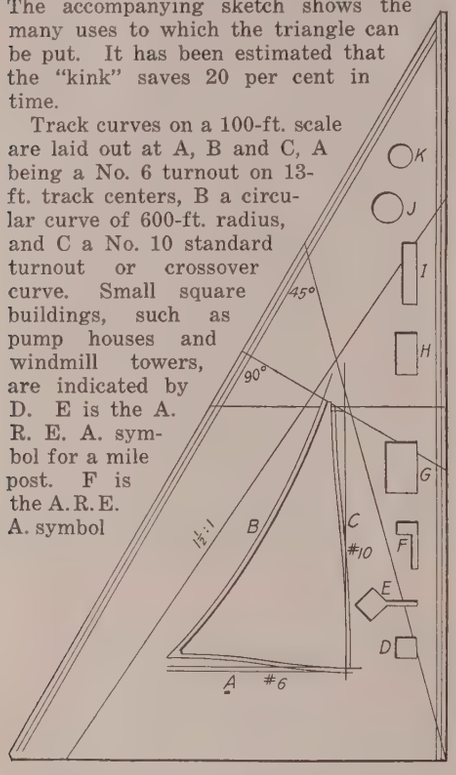
The material would be sluiced from the higher elevations of the north bank (care being used to reject the coarser rock), carried and distributed in pipe lines, which permit of more uniform spreading and mixing than the flume method, to a depth of about 6 ft. over the entire pool floor. This would form a uniform matrix of comparatively tight material, which, in turn, would be covered with about 6 in. of silt and slickings deposited by the water after its hydraulic duty was performed. If there were not enough silt in the run-off to give this depth, a sufficient quantity could be taken from the top soil to the north end and possibly from the south bank. This silt would work into the 6-ft. layer already placed and would become absolutely impervious, with no danger of breaking through; for the greater the pressure exerted by the water, the tighter the 6-ft. layer would be compressed and the greater the penetration.

Slopes would be built with the sheerboard step bulkhead method [see Engineering Record, Sept. 12, 1914, page 288], carrying a bench with about 12 ft. of horizontal surface, giving about 6½ ft. of depth perpendicular to slope line. The idea would be to hold the gradient of the stream behind the bulkheads as flat as practicable, reject the coarser material at the borrow pit and force the spoil-bearing stream against the original bank all the time. The result of this would be that the original bank would be fed, at every point, just as much water, carrying coarse and fine material, as it would take, resulting in a complete seal, and further resulting in having not only a seal within the original bank, but having outside, and protected by an outer belt of coarse material, a blanket about 2 ft. thick of fine material, which would accomplish the double purpose of supplying any fine material lacking in the original bank and forming a seal by itself.

Triangle Fixed to Simplify Taking Valuation Field Notes

FIELD NOTES for railroad valuation necessitate a considerable amount of neat, accurate sketching. In order to minimize time in getting this result Stephen R. Truesdale, of the valuation department, Chicago & North Western Railway, has taken an ordinary 6-in. 30 x 60-deg. triangle and drilled it to act as a stencil for some of the signs and symbols of the American Railway Engineering Association. The accompanying sketch shows the many uses to which the triangle can be put. It has been estimated that the "kink" saves 20 per cent in time.

Track curves on a 100-ft. scale are laid out at A, B and C, A being a No. 6 turnout on 13-ft. track centers, B a circular curve of 600-ft. radius, and C a No. 10 standard turnout or crossover curve. Small square buildings, such as pump houses and windmill towers, are indicated by D. E is the A. R. E. A. symbol for a mile post. F is the A.R.E.A. symbol for home signals; by notching blade-distant signals are indicated. G is used for section houses, stations and freight sheds, if they do not have to be drawn to scale, while H is used for section tool houses, crossing planks and pile bridge spans. For culverts, platforms and sheds I is used. Of the circles J and K, J is used for water tanks and towers, and K for wells, manholes and catch-basins.



TURNOUTS, BUILDINGS, SIGNALS AND CULVERTS ARE AMONG THE ITEMS READILY INDICATED IN THE FIELD NOTES BY THIS TRIANGLE

HYPOCHLORITE IN THE MILWAUKEE WATER SUPPLY causes trouble from tastes and odors when applied in sufficient quantity to eliminate gas-forming bacteria and when the temperature falls below 38 deg. Fahr. In his 1914 annual report H. P. Bohmann, superintendent of waterworks, states that in spite of reducing the rate to 2.3 lb. per million gallons trouble occurred. The average efficiency of the chemical in eliminating bacteria was 96.56 per cent. B. coli were present in the raw water on 189 days in 1 cu. cm and on 270 days in 10 cu. cm. In the treated water the corresponding figures are 3 days in 1 cu. cm and 48 days in 10 cu. cm. The average number of bacteria per cubic centimeter on gelatine in the treated water was 94, with a maximum of 2000 and minimum of 0. Corresponding figures for the raw water are 2590, 14,200 and 80.

Literature

For the Civil Engineer and Contractor

New Publications

PROCEEDINGS OF THE SECOND ANNUAL MEETING OF THE WASHINGTON IRRIGATION INSTITUTE. Paper, 6 x 9 in.; 186 pages. Prosser, Wash. L. L. Lynn, Secretary.

BOSTON TRANSIT COMMISSION, TWENTIETH ANNUAL REPORT, 1914. Cloth, 6 x 9 in.; 202 pages; illustrated, maps, diagrams and tables. Boston, City Printing Department.

COMBINED POWER AND HEATING PLANTS—PART III. A Treatise for Designing and Constructing Engineers, Architects and Students. By Charles L. Hubbard, B.S., M.E., consulting engineer. Cloth, 6 x 9 in.; 408 pages; illustrated. New York, McGraw-Hill Book Company, Inc. $3 net.

RAILROAD FIELD MANUAL FOR CIVIL ENGINEERS. By William G. Raymond, C.E., LL.D., professor of civil engineering and dean of the College of Applied Science in the State University of Iowa. Flexible leather, 4½ x 7 in.; 386 pages; tables and diagrams. New York, John Wiley & Sons, Inc. $3 net.

OVERCROWDING AND DEFECTIVE HOUSING IN THE RURAL DISTRICTS. By Harvey B. Bashore, inspector for Pennsylvania Department of Health, author of "The Sanitation of a Country House," "The Sanitation of Recreation Camps and Parks" and "Outlines of Practical Sanitation." Cloth, 5 x 7½ in.; 92 pages; illustrated. New York, John Wiley & Sons, Inc. $1 net.

SECONDARY STRESSES AND OTHER PROBLEMS IN RIGID FRAMES—A New Method of Solution. By George Alfred Money, C.E., M.S. Paper, 6¾ x 10 in.; 17 pages; illustrated. Minneapolis, Bulletin of University of Minnesota.

Applies a well-known graphic method to the problems of continuous beams, framed bents, building frames and secondary stresses in bridge trusses.

AMERICAN ASSOCIATION OF PORT AUTHORITIES—Proceedings and papers of the third meeting, held at Baltimore, Sept. 8-10, 1914. Paper, 6 x 9 in.; 286 pages; illustrated. New York, Office of the Secretary, 29 Broadway.

In addition to the report of the convention held last September there is a 39-page "summary of ports," giving information concerning nearly forty sea and lake ports in the United States and Canada.

METAL LATH HAND BOOK. Edited by H. M. McMaster. Cloth, 6 x 9 in.; 128 pages; illustrated. Youngstown, The Associated Lath Manufacturers.

This book is designed to place concisely before architects and contractors the best methods of using metal lath, and illustrations, descriptions and observations by the best authorities on construction affected by its use. A condensed record of various scientific experiments, particularly fire tests, is also included.

PROCEEDINGS OF THE FIRST ANNUAL CONVENTION OF THE CITY MANAGER'S ASSOCIATION. Reported by C. M. Boling. Paper, 6 x 9 in.; 46 pages. Springfield, Ohio, City Managers' Association.

A complete report of the meeting held Dec. 2, 3 and 4, 1914, at Springfield. Contains comprehensive discussions of the problems confronted by city managers, including financial methods, handling of public service corporations and contractors, and the relation of the engineer to city government.

Books Reviewed

Direct-Acting Steam Pumps

Author, Frank F. Nickel, associate in mechanical engineering, Columbia University, New York City. Cloth, 6 x 9¼ in.; 258 pages; 218 illustrations. New York, McGraw-Hill Book Co., Inc. $3 net.

This book is strictly what its title indicates except for the chapters on "Performance Factors" and "Duty," which are perfectly general and apply to any steam pumps.

The first chapter is historical, showing the development of the direct-acting pump. About 100 pages are devoted to description of different types of pumps, and a large number of cuts, obviously from makers' catalogs, are shown.

A chapter each is given to pump-end details and steam-end details and one chapter to comparative adaptability of different types to service conditions. The book would probably prove useful as a reference work for designers of this type of pump.

Oxyacetylene Welding and Cutting

Author, C. H. Burrows. Boards, 3 x 8½ in.; 134 pages; 65 illustrations. Minneapolis, Vulcan Process Co., $1.50.

The purpose of this book is to explain the subject of oxy-acetylene welding and cutting, both as to the underlying theory and as to its practical application, to mechanics and welders in general. It is written in such a manner as to be thoroughly understandable by them, and yet at the same time comprehensive. That the author has succeeded in his purpose no one who has read through his work can doubt. From cover to cover he does not deviate once from the ideal he set for himself and in no place has he inserted a passage that should not be readily understood by anyone possessed of even the barest rudimentary education. When the reader reaches the last page he feels that he has learned something, and with no great mental effort at that, which is about the highest praise the author should desire. How much the mechanical part of the make-up of this book has to do with its easy reading is problematical, but there can be no question that it aids materially, as the printing is clear and sharply defined and the quality of the paper of the best. Though the work is intended primarily for the class of men already cited, one cannot but be struck with the thought that it might prove profitable for many contractors and even engineers to at least glance through its pages, for it is the opinion of the reviewer that the full possibilities of oxy-acetylene welding and cutting are not thoroughly appreciated by such men. There are many tons of expensive castings being thrown on the junk pile, even today, that could be just as well saved were the uses of this form of equipment more thoroughly understood.

McGraw Waterworks Directory

Cloth, 6½ x 9 in., 616 pages. New York. McGraw Publishing Company, Inc. $15.

For years there has been need of a directory of waterworks of the United States and Canada. Time has outstripped the excellent "Manual of American Waterworks," edited by M. N. Baker and published in 1897. Now the need has been filled and the publishers promise a new edition annually, thus guaranteeing a reference book always up to date.

The first issue, just off the press, lists 5185 towns in the United States and Canada. As to each there is given the essential facts as to ownership and management, source of supply, purification, pumping equipment, distribution system and rates. As a consequence of the degree of completeness of the list and of the information furnished on the plants, it was necessary to make the book twice as large as planned.

The book is arranged alphabetically by States, with the towns in alphabetical order under each State. The description of each waterworks is given under the town which it supplies, and if additional towns are supplied from the same plant, they are listed after the statement about ownership.

The listing for the city of Bristol, Conn.,

which follows, is typical of the character of information presented:

BRISTOL, 9,527

MUNICIPAL. Office, 29 Prospect St. Supplies Forestville.
Chm. Comrs., Chas. L. Woodling.....Bristol
Comr., Daniel F. Crowley..... "
Sec. & Des. Engr., Alexander Harper..... "
Supt., Arthur W. Jepson..... "
Impounding reservoirs; 4¼ mi. from center distribution, 3-364,000,000 gal.; no purification.
Gravity distribution from reservoir, 57,000,000 gal.; standpipe (1900) 30 ft. in diam. 35 ft. high iron.
Pipe, 32 mi. 4 to 12-in. c. i.; 2½ mi. 14 to 30-in. c. i.; 700 ft. above 30-in. c. i.; hyd. 133, hose con. 2½-in. Ludlow; valves, 298 r. h. opening Renssalaer and Ludlow; meters, 1595; av. daily cons. 1,236,000 gal.; serv. con. 1961; ord. pres. 30 to 120 lb., fire pres. same.
Rates; flat, $6 year, bath $3, closet $3; meter, 18c. 100 cu. ft. max., 5½c. min.

A statistical summary giving the number of plants by States and an analysis of ownership and of types of pumping equipment used, closes the book.

The book is very well printed and bound, the large type being in striking and welcome contrast to the small sizes generally used.

Published independently of this book, but part of the same enterprise is the "Waterworks Buyers' Guide and Reference Manual," which is furnished free to superintendents and engineers of waterworks in return for the information furnished by them concerning their plants.

Further Problems in the Theory and Design of Structures

Author, Edwart S. Andrews, B. Sc. Eng. (Lond.), late demonstrater and lecturer in the Engineering Department of University College, London; lecturer in theory and design of structures at the Goldsmiths College, New Cross. Cloth, 6 x 9 in.; 234 pages; 99 illustrations. New York, D. Van Nostrand Company, $2.50 net.

Reviewed by F. H. Constant

Professor of Civil Engineering, Princeton University, Princeton, N. J.

This is a continuation and to some extent an overlapping of the author's earlier book on "Theory and Design of Structures," the third edition of which was reviewed in the Engineering Record of Nov. 22, 1913, page 588. The earlier book may be criticised as attempting to cover too much ground, ranging, as it does, from elementary graphics and simple beams to suspension bridges and hingeless arches, from the practical design of steel structures to earth pressure, retaining walls, reinforced-concrete beams, gravity dams, foundations and voussoir arches. The present volume is more definite in its aim and is confined to the mathematical development of the stresses in the so-called higher structures. The book will seem quite mathematical to the casual critic, but the author has deemed it advisable to insert the intermediate mathematical steps.

The book contains 234 pages and is subdivided as follows: Chapter 1 is on ordinary influence lines for simple beams and criteria for wheel loads. The advantages of the moment table in numerical calculation do not seem to be appreciated by the author, a graphical method taking its place. Chapter 2 gives influence lines and criteria for simply supported trusses. Chapter 3 relates to influence lines for fixed and continuous beams, and tables of coefficients facilitate the numerical calculations. Built-in and two-span bridges receive the major attention.

Chapter 4 covers influence lines for arches and suspension bridges. In the latter the cable is assumed always to retain its parabolic form and to exert a uniform upward load on the stiffening girder, and reference is made to a standard American work for the more exact solution. Chapter 5 treats of deflections in frames by the algebraic and the graphic (Williot diagram) methods. A number of examples are worked out in detail. Chapter 6 is on stresses in redundant frames. Chapters 7 and 8 take up arches again at greater length, completing the two-hinged arch with some of its special forms and including a short treatment of the hingeless arch rib. Chapter 9 develops stresses in portals and wind bracing and includes continuous portals and a very brief analysis of wind stresses in tall buildings. The book concludes with a chapter on secondary stresses, due to eccentric connections and the rigidity of joints. The methods are illustrated by numerical examples.

The work is a brief survey of the higher field of structural analysis. It is intended for English readers, to fill the need there, which has already been so satisfactorily met in American literature. It covers no ground not already familiar to American readers, but will interest the latter in serving as a supplement to our own excellent treatises on the subject.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

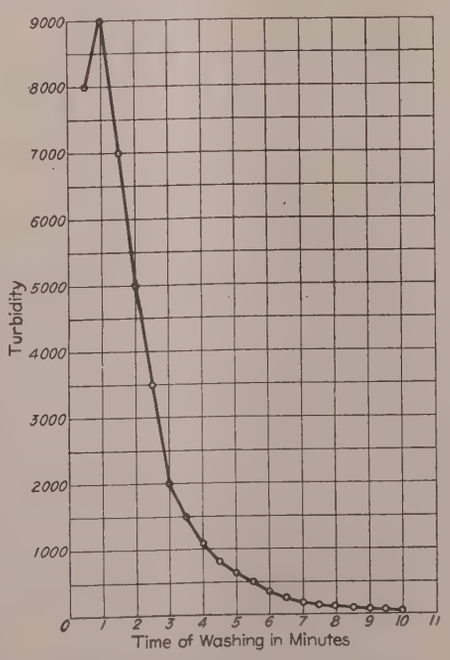
Wash-Water Tests

SIR: It occurs to me that some of your readers who are concerned with the operation of rapid filters may be interested in the accompanying diagram showing the results obtained at Ithaca of testing the wash-water for turbidity at varying intervals after the beginning of the wash.

The purpose was to determine the proper time period for running the wash-water through the sand, and an arbitrary value of 50 was chosen as a satisfactory condition of the wash-water as it came from the bed. The diagram shows that 9½ minutes were required to reach this condition, so that a period of 10 minutes was decided on as a proper period for washing.

The turbidities were determined by dilution and comparison with silica standards, and readings were taken at half-minute intervals from the instant the wash-water began coming through freely.

The break at the beginning is evidently caused by the fact that some time is necessary before the maximum turbidity is reached and this condition was even more marked in some of the other beds.



WASH-WATER TEST AT FILTER 5

52-hour run before washing. Loss of head 7.9 ft.

The smooth curve obtained, as well as its shape, is especially interesting.

HENRY N. OGDEN,
Professor of Sanitary Engineering, Cornell University.
Ithaca, N. Y.

Torresdale Laboratory—A Slip of the Pen

SIR: I note a misprint in the article contributed by me for your issue of May 8, page 591, on the sedimentation basin at Torresdale. Under my name appears "Chemist in Charge, Torresdale Filters," which should read "Chemist in Charge, Torresdale Laboratory." Jos. S. V. Siddons is superintendent of the Torresdale filtration plant and the operation of the filters is under his direction.

The Philadelphia Bureau of Water operates two laboratories, one at Belmont, with Dr. Geo. E. Thomas chemist in charge, and one at Torresdale with the writer in charge. These laboratories operate independent of the filter plants and report to S. M. Van Loan, assistant chief engineer. The five filter plants are each in charge of a superintendent.

FRANCIS D. WEST,
Chemist in Charge, Torresdale Laboratory.
Philadelphia.

Should Not the Name Gatun Be Changed to Sibert?

SIR: I am pleased to learn that President Wilson has by executive order changed Culebra to Gaillard.

Having, as No. 33,891, been associated with the gang who "shattered a continent's spine" I was surprised to have been asked by many engineers, since my return to "the States," the names of the division engineers on the Panama work. These division engineers certainly deserve to be immortalized, and the change from Culebra to Gaillard is only just. But why stop at this?

My service in Panama was with the Atlantic Division, and I would like to head a move to have Gatun changed to Sibert, and feel that I will be seconded by every man who worked under Col. W. L. Sibert. From the deep study he gave every detail of the work in his division, his ability to "listen well," his questions always to the point, and his dead cigar, which he never possessed

the means of lighting, we certainly considered him the "matchless division engineer."

A. C. Cornelison,
Formerly Superintendent, Porto Bello, Atlantic Division, Panama.
Tehuacana, Texas.

Length of Life of Walls of Mortar on Metal Lath

Sir: In connection with appraisal work on factory buildings the writer is endeavoring to collect data on the life of their outside building walls of Portland cement mortar plastered on metal lath. Inquiries among a limited circle of engineers and architects in the Pittsburgh district have brought replies giving the life as from three to nine years. The replies, however, have been so few that the writer would appreciate the opportunity of getting a more general expression of experience with this type of wall construction through the publication of this letter.

J. C. Crouse, C. E.
Pittsburgh.

[Probably there are readers of the Engineering Record who can give Mr. Crouse more definite information.—Editor.]

Best Steam Plants Rival Diesel Engine in Economy

Sir: I was much interested in Mr. Hammond's article, "The Diesel Engine for the Contractor—Why Not?" in your issue of March 27, page 409. The table on page 410 brings out very clearly the saving that an up-to-date Diesel engine could make in the cost of power where an ordinary contractor's steam plant is in operation.

I would like to call your attention to the fact that this same saving, and perhaps a greater, could be made by an up-to-date steam plant. For instance, the Locomobile type steam plant will deliver a horsepower-hour per pound of coal and on test conditions has done 20 per cent better than this. This would cut the fuel bill from 2½ times that of the Diesel engine down to ½ that of the Diesel engine under the conditions mentioned in the table, and would also cut the labor cost materially, as a 500-hp Locomobile plant does not require five firemen.

With coal at $2 a ton and oil at 3 cents a gallon the Diesel engine will not usually be found better adapted for the contractor than the steam plant, but with coal at $3 or more a ton and oil at 3 cents or less a gallon the Diesel engine will often be found the better source of power. The trouble is that contractors are prone to take any kind of a boiler that will make steam and any kind of an engine that will turn over, regardless of its steam consumption, when careful figuring would show a more expensive plant to be more economical. This plant might be a Diesel engine plant, a steam plant or even a gas producer under certain conditions.

Geo. L. Sullivan,
Professor of Mechanical-Electrical Engineering, University of Santa Clara.
Santa Clara, Cal.

[Economical stationary steam plants are not portable—not even as portable as the Diesel engine. That is why contractors are still sticking to locomotive and other fire-tube types of boilers. Further, if an efficient steam plant is designed for a job requiring a given number of horsepower, it will be hard to split that plant into independent units, for a smaller job, or to add to it for a larger job without either impairing its efficiency or going to disproportionate expense. A Diesel-generator station of several 50 or 100-hp units, on the other hand, may be broken up or recombined with other units in the most flexible manner without affecting its efficiency.

Further, the Diesel-engine generator set is self contained. When a contractor moves a steam plant, especially if he subdivides it, he throws away all the labor and about half the material, such as pipes and fittings, etc., used to set it up. Never is a contractor able to set up a boiler and engine plant again with the same piping which he took down. This type of installation charge mounts up after a few moves. It takes a good crew of pipe-fitters, for instance, to set up a 2000-ft. steam air plant in a week. The Diesel engine, on the other hand, is stripped for shipping like an air compressor, and goes together at its destination just as it came apart.—Editor.]

Ethical Advertising for Engineers

Sir: It is a ticklish proposition for engineers, this business of advertising. A member of the American Society of Civil Engineers or of similar organizations faces the statement that self-laudatory advertising is unethical, and uses that as an excuse for neglecting proper publicity methods. Much of the seat-warming between jobs is directly traceable to just this neglect. In contrast, a rising young technical graduate unhampered by any such supervision runs a card in the "Daily Blast" stating that he "is prepared to undertake difficult work in any part of the State." It is a difficult problem to keep one's name before the public, and many engineers have not yet solved it.

No attempt will be made here to present a treatise on advertising. Rather will be given a few of the ideas a consulting engineer in one of the Central States has used. His field is, to a large extent, the development of coal properties, as well as railroad construction and land surveying. His potential clients are widely distributed over three States.

His stationery is uniform and of a good quality. A distinctive style of type is used on all of his printed matter. The same style predominates on all his maps and plans. This style of lettering, wherever seen, tends to suggest his name and business to his clients—and this is the prime purpose of all his advertising.

On his maps he has developed several distinctive features, perhaps not advertising in the strictest sense of the word, but things that people soon begin to notice and look for. A black dragon, in profile, is on every map, either in the corner or supporting the meridian. This dragon is recognized as his trade mark. All his tracings are finished with a solid black margin, from a line parallel to and ¼ in. outside of the border line to past the trimming line. This gives to blueprints a white margin, and sets them off with distinction.

For distribution there are blueprinted calendars, say "done in my own office and a sample of my work." These calendars hang in the offices of nearly every coal company in his territory. A letter is sent with each one that suggests to the recipient that the calendar is well worth keeping. Besides these, he occasionally publishes blueprinted charts and maps of general interest. Some of the charts have been: "The Counties of Ohio—Date of Formation and Constitution"; "The Coal Measures of the State, Geologically Arranged," and the like. Among the maps, one showing the original land-grant lines of a certain section was very popular. Another showed the location of the lines run by Washington in West Virginia. These charts measure from 18 x 36 in. to 36 x 36 in. A cheap quality of paper is used, and the cost is by no means prohibitive. They are priced as though for sale, but are sent without charge to possible clients.

Photographs of general interest of construction done under this engineer's supervision, or of his design, are occasionally sent out. They are well mounted and are neatly lettered with his business-card text and a title.

Of literary ability this engineer claims none, and he has not entered that field. There is no reason, however, for anyone keeping out, if he can get his productions published. It seems to be one of the best publicity methods known.

These are but a few of the many advertising methods that the great majority of engineers have never tried. Many jobs have been traced directly to their use; and there is no doubt whatever that they have paid.

William O. Sell,
Vanderbilt University.
Nashville, Tenn.

Should the Full Pile or Only That Below Cutoff Be Paid For?

Sir: We are writing to ask your opinion on a matter which has recently come up in connection with a pile-trestle bridge contract where creosoted piling were driven and cut off to an even grade to receive the caps. The contract calls for payment on creosoted piling at 58.3 cents per linear foot of pile in place, the contractor furnishing the material and labor.

The piles were driven by the contractor in lengths called for by the engineer of the owners, and the owners' engineer also directed when the piles were driven to his satisfaction. The question has arisen whether the contractor is entitled to payment for the entire pile used, at the price of 58.3 cents per linear foot, or whether he should receive only payment for that portion of the pile below cutoff. The specifications contain nothing to cover this point, so that the common practice of the profession under the conditions given would probably decide the matter. We would greatly appreciate your opinion in the matter.

The total number of piles in the contract was approximately 1000 and the average length cutoff was approximately 3.3 ft.

Paul Muñoz,
Muñoz & Muñoz, Contracting Engineers.
Los Angeles.

[The attention of Mr. Muñoz and others interested is called to an editorial on the subject in the fore part of the paper.—Editor.]

In Construction Work in Chile, such as ditching, railroad grading and the building of dikes and levees, the material is usually moved by hand, states V. L. Havens, commercial attaché at Santiago. He suggests, therefore, that the country could be made into a good field for American grading machinery.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

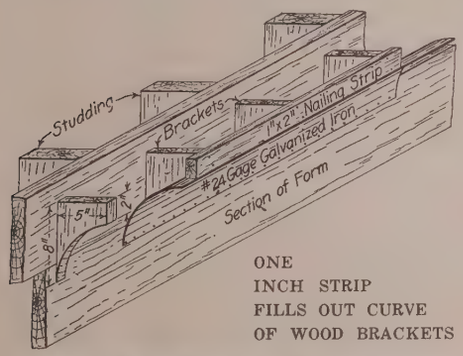
[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Form Nosing Made of Curved Brackets and Sheet Iron

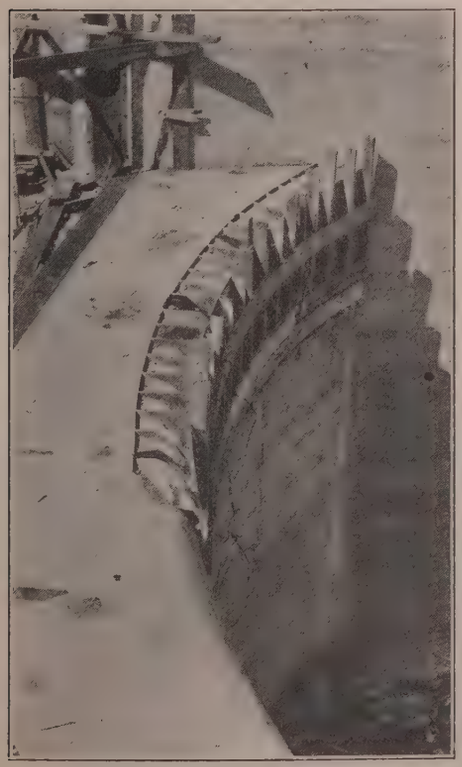
By R. SICKLES
Larkin & Sangster, Seneca Falls, N. Y.

A CHEAP molding for a nosing at the top of a concrete wall, or for rounding off the corner where the wall angles in plan, may be made of sheet iron. It is made by shaping and fastening tin to brackets or ribs sawed to the required radius.

For making a 6-in. nosing, for instance, the brackets are ripped out on a band saw to a 6-in. radius. It will be seen from the sketch that the curve is 1 in. short of making the complete quarter turn. These brackets are nailed to the form at the proper grade, and a 1 x 2-in. strip nailed to the front of the brackets, as shown, thus



ONE INCH STRIP FILLS OUT CURVE OF WOOD BRACKETS



NOSING MADE OF SHEET IRON

rolls. The run of the molding is made up of short lengths, depending on the width of the tin as it comes on the work, and butt-joined at a bracket.

The photograph shows this method employed for an 18-in. nosing on a wall curved to a 30-ft. radius.

Five Factors for Selecting Road Hauling Equipment

THE five factors that should be considered in selecting highway hauling equipment as given by Fred Tarrant, division engineer, in the April bulletin of the Illinois Highway Department, are as follows:

1. First cost—Some machinery will pay for itself in a comparatively short time and it can be readily foreseen whether there is work enough ahead to make the investment profitable, while other equipment requires an enormous outlay and must be used a number of years before first cost is realized.

2. Depreciation, which is often figured too low.

3. Maintenance, which not only includes repair work, but also cost of delays due to the idle time of machine.

4. Cost of operation, which should be taken under average and normal conditions.

5. The speed with which a machine performs its work.

Mr. Tarrant states that it is advisable to get a machine that is suitable for different classes of work rather than one which is highly suitable for a certain class of work, but which, due to lack of adaptability, may be idle a large portion of the time.

Cast-Iron Pipe Laid in Slings and Lowered on Screws

AN inverted siphon of 36-in. cast-iron pipe was recently placed under the South Platte River by lowering it in one piece on long screws. The inverted siphon is an extension from the new 60-in. conduit

CAST-IRON PIPE IN SLINGS WAS LOWERED SIX FEET TO BOTTOM OF TRENCH

described in the Engineering Record of Oct. 19, 1912, page 424, and Jan. 18, 1913, page 60. It is used to carry water from the intake to the Platte Canyon reservoir. The 30-in. wood-stave line, shown in the photograph, carries settled water from the reservoir to the rapid filters at Willard.

All the water flowing in the river was diverted through various canals, but it was not practicable to draw down the ground water in the gravel bed to the bottom of the trench, therefore the pipes were yarned and calked above the water level and then lowered away by unscrewing the nuts on the threaded supporting rods. One rod was apportioned to each pipe at a point 1 ft. back of the bell end. Men with wrenches were stationed at each nut and all acted simultaneously in lowering the pipe. The drop of 6 ft. was accomplished in 12 hours. The river section, 200 ft. long, was laid in four days.

The work was carried out under the direction of D. G. Thomas, chief engineer of the Denver Union Water Company.

Set Record in Repairing 30-Ton Stone-Crusher Spider by Welding

WHAT is said to be one of the largest oxyacetylene welding jobs ever accomplished was completed recently in Chicago when the cracked and broken hub of a 30-ton iron spider for a gyratory stone crusher was repaired. The section of the spider shown in the accompanying photograph weighs 60,000 lb. and the complete spider, which includes a segment not shown,

IT REQUIRED 60 HOURS AND 900 POUNDS OF NEW METAL TO WELD THIS HUB

weighs 80,000 lb. After the crack and break were chipped out, the opening was so large that it required more than 900 lb. of new material to be welded in.

The welding was carried on continuously in shifts of two men each for sixty hours before the job was completed. The fractured hub was buried in a charcoal fire during welding operations in order to prevent local expansion or contraction. This fire was built in a temporary brick furnace 7 ft. square and 4½ ft. in height erected around the hub. After the welding was finished the whole spider was covered with sheet asbestos and allowed to cool off gradually. Irrespective of the time lost it would have cost the stone quarry about $2300 for a new casting. The repair cost only a fraction in time and money required of the price of a new casting. An entire flat car was required to bring the large patient to the Chicago shop of the Oxweld Acetylene Company.

System in Managing Camp Boarding-House Pays Contractor

By T. EADINGTON
Occidental Construction Company, Inc., Los Angeles, Cal.

THE boarding-house in a construction camp presents a double source of profit which is frequently overlooked by the average contractor. In his opinion, the boarding-house is a regrettable necessity; the men have to be fed, and he puts up as best he can with the succession of bad cooks, complaints from the men, and all the other petty annoyances incidental to running the boarding-house. If by good luck the boarding-house pays its way and the men do not all leave him, he is amply satisfied with the result. Experience, however, has shown that with proper management a reasonable profit can be made on the boarding-house and petty annoyances and causes of complaints mitigated. The effect on the temper and efficiency of the working force is an important item.

There must be an efficient method of buying the supplies, and of handling them in the camp. For this purpose, the camp timekeeper is the most suitable person. He should be held responsible for the adequate supply of all foodstuffs, and should report on a daily form the receipt of all goods, arranged alphabetically, and the consumption and cost of food in the boarding-house during the day. All supplies should be kept in the commissary room and dealt out to the cooks daily on requisition to the timekeeper. At the foot of the daily report is a summary, showing the daily cost of labor and foodstuffs in the boarding-house, and against this is placed the number of meals supplied and the receipts therefrom. The check on both cooks and timekeepers is an incentive to avoid wastage, and the cooks may be encouraged to achieve further economies by the promise of an increase in wages for a cost reduction in meals.

Under normal conditions meals can be provided at an average cost of eighteen cents. This provides for an ample and varied diet. Usually, the charge to men for meals is twenty-five cents per meal, and as will be seen this leaves a good margin of profit. In a camp of fifty men at this rate the boarding-house will show a profit of about $300 per month; and there have been contracts where the boarding-house was the only redeeming feature of the job.

DAILY BOARDING-HOUSE REPORT

Camp ..... Date .....

Articles	Rec'd	Used	Cost	On hand
Apples, dried				
Apricots, dried				
Bacon				
Beans, Lima				
Beans, pink				
Beans, white				
Beans, string				
Beef				
Beets				
Baking soda				
Baking powder				
Cabbage				
Carrots				
Catsup				
Cheese				
Cinnamon				
Cloves				
Coffee				
Coal				
Coal oil				
Corn starch				
Corn meal				
Corn, canned				
Chili pods				
Crackers				
Eggs				
Extract, lemon				
Extract, vanilla				
Extract				
Fly paper				
Flour				
Ginger				
Ham				
Hops				
Hominy				
Jelly				
Lard				
Lye				
Macaroni				
Matches				
Milk				
Mustard				
Nutmeg				
Oats				
Oleo				
Onions				
Peaches, dried				
Peaches, canned				
Prunes				
Pickles				
Pepper				
Potatoes				
Pork, dr. salt				
Peas, canned				
Pie, fruit				
Pumpkins, canned				
Raisins				
Rice				
Saltpetre				
Salt, dairy				
Sauerkraut				
Soap				
Sugar, gran.				
Syrup				
Sago				
Tea				
Turnips				
Tomatoes				
Vinegar				
Washing powder				
Washing soda				
Yeast				

Cooks			
Flunkeys			
Timekeeper			
Cost of labor			
Cost of supplies			
Total			

Meals served			
Cash meals served			
D.H. meals served			
Total			

..... Timekeeper.

Patching Grouted Brick Pavements

By P. J. MASTERSON
Superintendent of Street Repairs, Cleveland

CITY FORCES in Cleveland relay all pavements that have been cut for pipe laying, etc. In the case of brick pavement a long-handled chisel is the best instrument for making the original cut in a pavement. After an opening has been broken with a maul the chisel can be used to cut and pry out each brick separately, making a clean opening and facilitating the patcher's job. The brick used in making the patch should be carefully measured and matched for size as well as color. Where the new brick are a hair's breadth thicker than the old ones, the courses are thrown out.

The proper compacting of the sand cushion presents a difficulty that is not found in new jobs of paving. Sand has probably been lost from under the edges of the original pavement next to the excavation, and it is necessary not only to compress the sand cushion downward in making the repairs, but to force it latterly under the edges of the old pavement. For this purpose we use a form of sand rammer, consisting of an iron handle 6 ft. in length, with a rectangular head turned at an angle of 45 deg. from the line of the handle. An ordinary wooden rammer or a narrow hand roller does the same service for the width of the patch.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Revaluation of Reclamation Service Projects Under Way

Hearings Being Held Which May Result in Readjustment of Construction Charges on Which Assessments Are Based

Last January the Secretary of the Interior announced that he proposed to have a revaluation made as to the construction cost of the projects of the U. S. Reclamation Service. The work is now well in hand, all of the local boards of review having been appointed and complete instructions issued for their procedure.

The reason for the revaluation is that there have been objections on the part of the water users to some of the items entered in the construction cost for determining the figure on which the charges to the settlers are based.

Local Boards

A local board of review has been appointed for each project, each board consisting of one representative of the Reclamation Service, one representative of the Water Users' Association of the project and a third member nominated by the Reclamation Service and water-users' representatives of a given division and then appointed by the Secretary of the Interior. The third member, therefore, on all of the local boards of review of the division in which he is appointed, while the representative of the Reclamation Service and of the Water Users' Association, serves only on the local board for each particular project.

The reports of these local boards of review are to go to a central board of review composed of Elwood Mead, at present chairman of the State Rivers and Water Supply Commission of the State of Victoria, Australia, who is to return to the United States in June of this year to resume his position as a member of the faculty of the University of California; Brig.-Gen. W. L. Marshall, U. S. A., retired, consulting engineer to the Secretary of the Interior, and I. D. O'Donnell, supervisor of irrigation of the Reclamation Service.

The third members of the local Boards of Review are as follows: Southern Division, Thomas U. Taylor, dean of the engineering department, University of Texas; Pacific Division, B. A. Etcheverry, professor of irrigation engineering, University of California; Northern Division, Edward Gillette, civil engineer, Sheridan, Wyo.; Washington Division, O. L. Waller, professor of civil engineering, State College of Washington, Pullman; Rocky Mountain Division, P. J. Preston; Central Division, C. R. Burkey.

Scope of Review

The instructions as to details recently issued authorize the boards of review to make recommendations as to the following items:

1. Elimination of any item of cost which should not be included as a basis for construction charges.

2. Inclusion of any item of cost properly chargeable but not heretofore charged.

3. Disposition of any accrued operation and maintenance cost not already assessed as an operation and maintenance charge.

4. Irrigable acreage to be employed as a factor in determining the construction charges per acre.

5. Subdivision of the projects into various units or consolidation of units for the assessment of construction charges.

6. Need, expense and cost of a suitable drainage system for each project and method of paying for the cost of such drainage work.

The original instructions call for the filing of the reports of the local boards of review with the central board by July 1, 1915. Hearings on local projects are now in progress.

California Legislature Approves $15,000,000 Highway Bond Issue

The $15,000,000 highway bond act, under which the proposal of issuing bonds to this amount will be submitted to the voters of the State, was passed by the California State Legislature, May 7. No opposition to the measure developed because, in addition to the $12,000,000 bond issue requested by the Highway Commission, the bill provides an additional $3,000,000 to be applied as may be deemed necessary to eight branch highways.

Civil Engineers Indorse Offering War Services to Government

By a chorus of aye's, indicating that every man in the large gathering was heart and soul back of the resolution, the meeting of the American Society of Civil Engineers, on May 19, endorsed the proposal that the society offer its services to the Government to assist in developing a reserve engineering corps. Following the approval of the resolution, which was offered by R. S. Buck, engineer maintenance of way of the New York Railways Company, the secretary, Charles Warren Hunt, announced that at the suggestion of Major-General Leonard Wood the society, through its board of directors, had already taken the organization of such a reserve engineering corps under advisement. The board had appointed as a committee to study the subject William Barclay Parsons, New York (chairman); A. M. Hunt, San Francisco; F. S. Washburn, Knoxville, Tenn.; Samuel H. Hedges, Seattle; Charles L. Strobel, Chicago. The secretary believed that the action of the meeting would be construed by the board of direction and the committee as approval of their procedure and would encourage them in their investigations. The chairman of the committee, Mr. Parsons, has already been in conference with General Wood.

Mr. Buck's resolution was preceded by a long preamble, reciting the unpreparedness of this country. The resolution itself was as follows:

"Resolved: That it is the sense of this meeting that the American Society of Civil Engineers should as promptly as possible, through its duly appointed officers, confer with the proper Federal authorities and place the facilities of its organization at their disposal to assist in developing a reserve corps of engineers to be used as required, either in construction of military works or for active service."

To Vote on Bond Issue for Lake Erie & Ohio Ship Canal

In accordance with a bill passed last week by the Pennsylvania Legislature the voters in the western counties of the State will decide on the question of bond issues to finance the construction of the much discussed Lake Erie & Ohio Ship Canal. The estimated cost of the canal is $50,000,000. The Governor of Ohio, however, has vetoed a bill allowing counties in that State to participate in the work.

Engineers Will Speak at New York City Officials' Conference

Nelson P. Lewis, chief engineer Board of Estimate, New York City, and D. L. Turner, deputy engineer of subway construction and member of the City Plan Commission, New York City, will be among the speakers at the annual Conference of Mayors and Other City Officials of New York State, to be held at Troy, June 1-3.

A National Waterworks Association Is Proposed

In Presidential Address at Cincinnati Convention of American Waterworks Associaton Last Week George G. Earl Suggests Coalition of All Interests in United States

Overshadowing in importance any other event of the five-day convention of the American Waterworks Association at Cincinnati last week was the launching of a campaign for a national waterworks association—a country-wide organization with local branches to replace all the unaffiliated sectional bodies now in existence in the United States. In his presidential address, delivered May 11, George G. Earl, superintendent of the Water and Sewage Board of New Orleans, went on record in favor of a union of all waterworks interests in one large body and his views were later endorsed from the platform by Nicholas S. Hill, Jr., the newly elected president of the American association.

Although rumors of a coalition of the waterworks societies of the country have been in circulation for some time past Mr. Earl's speech, which is given in greater detail on page 643, is the first public utterance advocating the measure. To those who have followed the trend of affairs in the waterworks field of late the announcement was foreshadowed, in a way, by the American Waterworks Association's recent activities in the formation of local sections. The New York and the Illinois sections have been in existence for some time past and last week two others joined the ranks—a Central States section and an Iowa section. News also was received from Allen Hazen that a California section might be expected at no distant date. While progress has been rapid in affiliating the Middle Western organizations with the American association a different situation arises in the East. While no specific mention of the New England Waterworks Association was made by Mr. Earl, it is apparent that upon the action of the latter body will depend the complete success of any comprehensive plan for the amalgamation of the waterworks societies of the United States.

Arguments for Consolidation

Among the arguments advanced in favor of a national association are these: Very few men can spare the time or money to attend several conventions; it is waste effort for busy men to undertake the preparation of technical papers for a large number of waterworks bodies. With separate organizations there is a great amount of duplication of work, particularly in the matter of standards of practice and standard specifications. It is believed also that a national association would have a much wider influence than would a smaller body.

It is still too early to gage the full effect of Mr. Earl's proposal. Opinions expressed by certain members of the New England Association who were present at Cincinnati indicate that any plan for the inclusion of the New England organization as a section of the American association would be difficult of attainment for the present, at least. However, there was evinced generally an appreciation of certain benefits to the field as a whole which it was thought would accrue from such a consolidation.

Opening Session

The convention opened May 11 with the ball-room of the Hotel Gibson filled to capacity. The final registration figures were 288 members, 174 associate members, and 311

guests. Secretary J. M. Diven's report showed a membership of 1147 on April 1 of this year. Applause greeted the announcement that 69 new members had been secured by the conversion of the Illinois Water Supply Association into a local section of the American association. The executive committee's report furnished an encouraging sign in the association's growth. An Iowa and a Central States section have just been formed, and a California section, according to information received from Allen Hazen, is a probability in the near future.

New Officers

The result of the election of officers for the ensuing year was as follows: President, Nicholas S. Hill, Jr., consulting engineer, of New York; vice-president, Leonard Metcalf, consulting engineer of the firm of Metcalf & Eddy, of Boston; treasurer, James M. Caird, consulting engineer, of Troy, N. Y.; trustees, Carleton E. Davis, chief of the Bureau of Water of Philadelphia, and Charles H. Rust, city engineer of Victoria, B. C. John Caulfield, secretary of the waterworks of St. Paul, Minn., whose activities in the American association date back to 1887, was unanimously elected as honorary member. One of the association's most influential members, Emil Kuichling, died during the year and resolutions of regret offered by A. A. Reimer were adopted. The healthy financial condition of the organization was indicated by the report of the treasurer, James M. Caird, which showed a balance on hand of $4,268.15.

Committee Reports

While a number of committees were scheduled to present reports only two announced anything more than progress. The first was the committee on water consumption, of which Edward S. Cole, hydraulic engineer, of New York, is chairman. This committee has assembled statistics from a number of cities and has divided the water consumption by classes into domestic, industrial, commercial and public. The committee on standard specifications for water meters recommended a 9-in. length for ¾-in. meters and a 10¾-in. length for 1-in. meters. A threaded coupling is advocated, for conferences with the meter manufacturers indicate that the increased weight of a flange coupling would add to the cost.

H. E. Keeler, chairman of the finance committee, presented a definite budget of next year's expenses which was passed by the association. Some of the items include $550 for convention purposes, $1500 for editor of journal, $5000 for the journal and $500 for the sections of the association.

Depreciation problems are in a chaotic condition and Leonard Metcalf, chairman of the depreciation committee, was of the opinion that no formal report should be presented at this meeting. Depreciation of railroad property is being studied by the American Railway Engineering Association, and the engineer corps of the Interstate Commerce Commission. It is desirable that waterworks properties with long life values should not be treated as a maintenance charge as is probably best for the relative short life values in railroad property.

A radical change in the method of electing officers went into effect by the passage of Morris R. Sherrerd's resolution amending the constitution and providing for the selection of a nominating committee of five members chosen by the delegates at the convention from the following five geographical districts—New England States, Middle States, Southern States, Central States, and the remainder of the United States and foreign territory. The nominating committee will select candidates for the various offices and these names will be voted on by letter ballots. Additional nominations may be made by twenty-five members of the association. Under the former plan, the selection of officers was done entirely by letter and the argument for the change is that it adds to the convention one of its most interesting features and allows the members to exchange views as to their choice.

Under the new plan the members from each geographical division met and selected the following nominating committee: Morris R. Sherrerd, of Newark, N. J.; R. J. Thomas, of Lowell, Mass.; M. L. Worrell, of Meridian, Miss.; John Caulfield, of St. Paul, Minn., and Henry Hymmen, of Berlin, Ontario.

Mr. Sherrerd also offered a resolution aiming to correct alleged injustices in methods of waterworks accounting by public utilities commissions. These commissions, it was claimed, require the charging of both sinking fund and depreciation against operation. When the income from a utility is sufficient to provide for both sinking fund and depreciation, revenue which might otherwise justify a reduction of rates is, by this method, excluded from consideration in rate making. Mr. Sherrerd proposed that the attention of the public utilities commission be called to the inequality resulting from this method of accounting and that they be requested to modify their requirements. After an animated discussion the resolution failed of passage.

Next Convention at New York

Keen interest was displayed in the selection of the place for the 1916 convention. The two chief contenders were New York and St. Louis, although nominations were made by Detroit, Richmond and Birmingham. New York was selected by a vote of 142 to 94 for St. Louis. The fact that the next meeting will be held in the East, it was pointed out, will afford members of both the American and the New England Waterworks Associations to confer on the proposed union of the two bodies as outlined by President Earl in his plea for a national waterworks association.

Technical Sessions

The features of the technical sessions were the papers on the manufacture of syrup of alum at the filter plant, by Charles P. Hoover, chemist in charge of the Columbus filtration plant, and on proposed changes in sand analysis by Philip Burgess, consulting engineer, of Columbus. Mr. Hoover's radical method of preparing coagulant was explained by him in detail in an article in the Engineering Record of May 8, and Mr. Burgess's paper, with discussion by Allen Hazen, is given on page 644 of this issue.

Mr. Hoover did not attempt to present his paper in full, but merely outlined its main points, using blackboard sketches to demonstrate the savings made by the process as adopted at Columbus. Costs will be cut $6000 a year by the change from crystallized alum to the new home-made syrup of alum. If his plans be followed elsewhere the high cost of filtering water is likely to receive a severe blow. Bauxite from Georgia and sulphuric acid are the ingredients from which alum is made, and the refining processes ordinarily used are eliminated where the alum syrup is discharged directly from the kettle to the filters, as is the practice at Columbus. Mr. Hoover has discovered a substitute for bauxite—halloysite—which reduces his already low costs. In the discussion of the paper it was brought out that the price of sulphuric acid had been doubled since the European war began, but A. W. Hawkes, of the General Chemical Company, announced that there would be no change in price for alum in crystallized form.

May 13 was "Superintendents' Day" and most of the time was taken up in a discussion of S. G. Highland's paper on plumbing and control of plumbers. A. A. Reimer, of East Orange, N. J., reported that in a system of mains 80 miles long 54 per cent of the leakage shown by a pitometer survey was traceable to leakage of house fixtures.

Laboratory Section

Half a hundred men attended the meeting of the chemical and bacteriological section, a gratifying increase over the handful of enthusiasts who started the section last year. W. F. Monfort added a note to his paper printed in the proceedings on "Dry Feed of Chemicals in Water Purification" to the effect that crenothrix had been found growing in 5-per cent iron sulphate solutions and had probably been the cause of much serious clogging of pipes. The source of the algal growth has not been run down. J. W. Ellms stated that the organism was present in the solutions at Cincinnati and caused much clogging. Using dry chemicals, of course, eliminates the difficulties.

Francis F. Longley's paper on the "Present Status of Disinfection of Water Supplies," read some time ago before the New York section, was again read and discussed briefly.

The examination of 100 water samples on railway trains has been carried out by Prof. Edward Bartow. From the results a great many would not pass the standards set by the Treasury Department committee. Sleepers and diners have better water usually than day coaches. C. P. Hoover in discussing the paper stated that scarcely any filtration plant in this country can meet the standards set and in consequence suspicion is cast on the plants whenever proper certification cannot be made. On twenty-eight days out of the year at Columbus gas was found in 1/10-cu. cm samples but on those days the average number of bacteria was but 3 per cubic centimeter. Further reduction of bacteria is hardly possible in his estimation. W. H. Frost, of the Public Health Service, explained that inspection of water sources was impracticable; hence the Government was constrained to put the responsibilty on the carriers and to make more rigid standards, because dependence had to be taken on the analyses without knowledge of the history of the water in question.

Wash-water reclamation was discussed, the consensus of opinion being that it was entirely feasible. With clear waters the residual coagulant forms a desirable matrix, expediting the formation of a new floc, said Mr. Hoover.

S. T. Powell contributed a paper on "Effect of Algae on Bicarbonates in Shallow Reservoirs." Dissolved oxygen rises and carbon dioxide is reduced due to growths. Supersaturation with oxygen often takes place and causes trouble with filters becoming air bound.

Prof. Bartow has been examining sulphate for small quantities of arsenic. He found the traces were so small they had no significance but the information obtained by independent research has value to chemists who are confronted with the question.

The following officers of the Laboratory were elected:

M. B. Litch, president; John A. Kienle, secretary; Paul Hansen, W. H. Frost and C. P. Hoover, executive committee.

Entertainment

As a prelude to the opening of the convention there was a reception and dance at the Hotel Gibson on May 10. On the afternoon of May 12 the members and guests embarked on the steamer "Island Queen" for a trip on the Ohio River to Cincinnati's $15,000,000 waterworks and filtration plant. Luncheon was served on the boat and on the return visit an inspection of the main pumping station was made. Thursday evening, May 13, was devoted to glee club concert and dance, and the convention terminated with a dinner at Chester Park, at which the Waterworks Manufacturers' Association were the hosts.

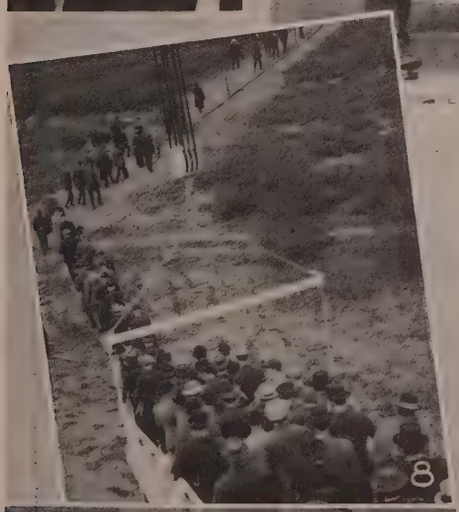
The Manufacturers' Exhibit

Sixty-two members of the Waterworks Manufacturers' Association had exhibits at the Cincinnati convention and the range of products on display covered practically every feature of waterworks practice from valve packing to a model of a modern mechanical filtration plant. The exhibit was staged in the rooms adjoining the convention hall and a steady stream of people passed through the aisles and inspected the articles on view. Of historical interest was a section of old wood water pipe, laid prior to 1830, at R. D. Wood

Members of American Waterworks Association Inspect Cincinnati Filters

1. Frank A. Barbour.
2. Entrance to pumping station.
3. Nicholas S. Hill, Jr.
4. John Caulfield.
5. George W. Fuller and J. Waldo Smith.
6. J. M. Diven and J. W. Alvord.
7. E. E. Davis.
8. Down the gang-plank.
9. Up-hill to filters.
10. Leaving the "Island Queen."
11. Mr. and Mrs. J. M. Caird.
12. E. S. Cole (at foot of gang-plank).
13. Dabney Maury (in foreground at right).

Photos by Engineering Record



& Company's booth. The Wallace & Tiernan Company, Inc., displayed its liquid chlorine apparatus and showed pictures of a Brooklyn installation for treating 200,000,000 gal. of water daily, which was set up in the brief period of twenty minutes. The Electro Bleaching Gas Company had on view its chlorinating apparatus, which was of the same type installed to treat the water supply for the Panama-Pacific Exposition at San Francisco.

The New York Continental Jewell Filtration Company and the Pittsburgh Filter Manufacturing Company each had on view a model of a mechanical filtration plant. The Eddy Valve Company displayed its fire hydrant with indicator post and automatic drain. At the Simplex Valve & Meter Company's booth was a recording gage for a mechanical filtration plant, showing on a single chart the rate of flow, loss of head and elevation of water on the filter.

A small low-priced meter tester was exhibited by the Ford Meter Box Company and the Sanitation Corporation operated with a small electric motor a complete model of a Riensch-Wurl screen for sewage clarification. The Mueller Manufacturing Company exhibited for the first time a new light weight drilling machine for 2 to 8-in. tools. The Badger Meter Company has entered the large meter field and displayed a 4-in. turbine and a 4-in. compound turbine meter.

The newly published "McGraw Waterworks Directory" was displayed at the Engineering Record's booth. The National Water Main Cleaning Company showed sections of pipe with heavy incrustations which reduced the carrying capacity of the conduits.

Suggest National Movement for Engineering Publicity

Co-operation of engineers in a national organization to promote engineering publicity, engineering employment and engineering legislation was the burden of a ten-minute prelude to Prof. F. H. Newell's illustrated address, May 17, to the Western Society of Engineers on the works of the engineer in the U. S. Reclamation Service.

Engineers are the barometers of future construction. When men begin to inquire for engineers to look over projects, a period of activity is ahead. When engineers are applying for places the reverse is true. Professor Newell stated he was not so sure engineers themselves were not partially to blame for these up-and-down curves of prosperity.

The co-operative movement among engineers would lay out a dignified consistent course of newspaper publicity to be fed out continually. It would be written in the layman's terms. As an example of what the right kind of publicity can do he noted the yellow-journal denunciations of the original Panama Canal endeavors and the well-planned, dignified publicity campaign at the time the Reclamation Service was first proposed. The latter drowned out the yellow-journal stories. This procedure is entirely justified in his estimation, because the public is entitled to know in its own Sunday-supplement way about the engineers' activities on public works.

The great problem of employment is to fit the round pegs into round holes, and at present to find any holes at all. The idea that there are only so many positions and the men out of work will find them some way is erroneous, said Professor Newell. As more engineers are employed in responsible positions they require additional engineers as their subordinates.

Railroad Commissioners Hold Valuation Conference in Chicago

State railroad commissioners from all sections of the country met in Chicago, May 13, and formulated plans for the action they will take at the conference on railroad valuation to be held in Washington, May 27, by the Interstate Commerce Commission. M. R. Maltbie, former member of the Public Service Commission, First District, New York, presided.

Make First Complete Official Map of New York City

Board of Estimate and Apportionment Consulted Wide Variety of Existing Sources in Making Large-Scale Map Exact

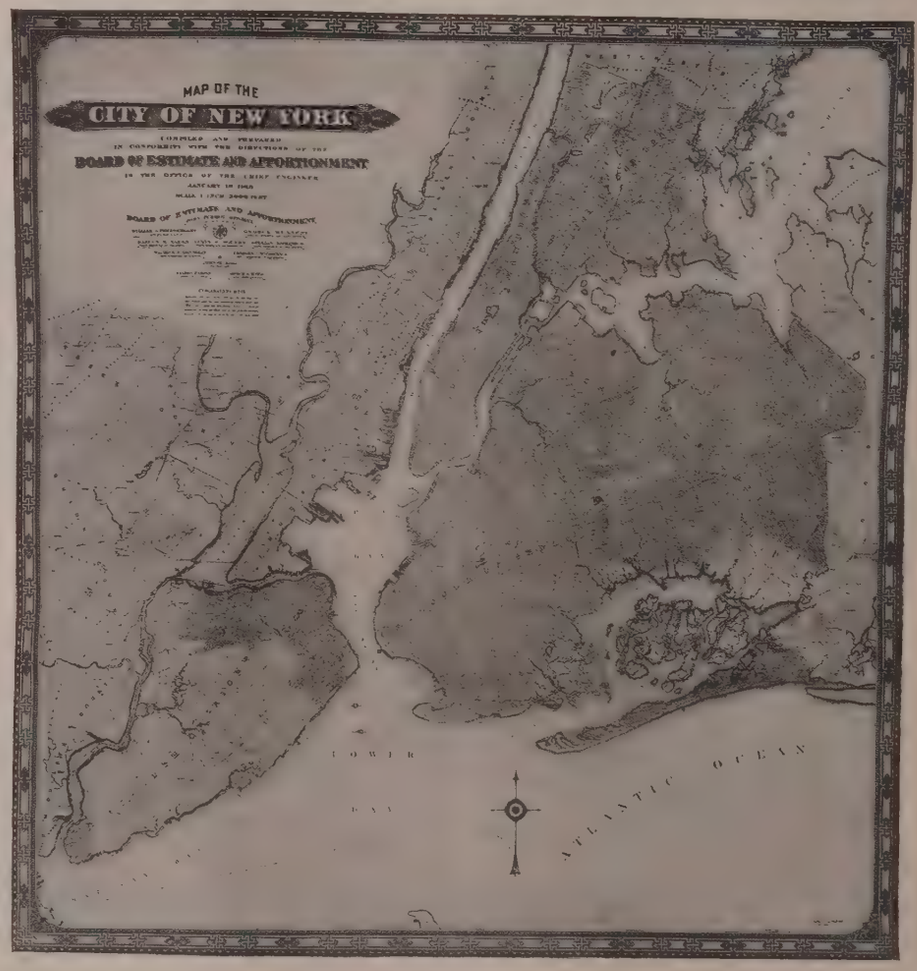
A correct and complete official street map of New York City and vicinity is now, through the efforts of the Board of Estimate and Apportionment, available for the first time. It was prepared primarily for the use of the various city departments. All of the departments have rendered valuable assistance in furnishing information concerning the territory within the city, in some cases having made original surveys. In mapping the area outside of the city valuable assistance was given by the Harbor Line Board, by the engineers of various cities and villages, by the trunk line railroads, by water companies, commissioners and surveyors. For a considerable part of New Jersey principal reliance was placed upon the State topographical sheets which were drawn to a scale of 2000 ft. to an inch. These sheets were enlarged by photography to the required scale in units of one square minute, and such corrections applied as could be obtained from other reliable sources.

Work on this map as a whole was begun on June 30 last, although the groundwork for it had already been laid in the preparation of an index map of the territory within the city limits. The map just issued covers the territory contiguous to New York both in New Jersey, Westchester County and Long Island. No coloring of any kind is used. The map shows simply the official street plan with existing roads drawn in light lines where official plans have not yet been adopted. The absence of color will permit the different departments to illustrate their various functional activities and to emphasize them in a manner which is impossible in the case of the map where emphasis has already been placed on certain features.

Large Size and Scale

The map includes the territory between latitudes 40 deg. 20 min. and 45 sec. and 40 deg. 55 min. 17 sec., a distance of 31.66 miles, and between longitudes 73 deg. 41 min. 30 sec. and 74 deg. 16 min. and 30 sec., a distance of 30.74 miles. In plotting, the polyconic system was used, and the range of variation in the length of one minute of longitude from 4,638 ft. at the southerly boundary to 4,605 ft. at the northerly boundary was taken into account. The entire territory was divided into twenty-one sheets, each representing a length of 51,708.4 ft. and a width of 25,426.3 ft., the actual size of the sheet being 8.01 x 3.53 ft. on a scale of 600 ft. to the inch. After a long series of tests, a heavy white paper was selected on which to make the original drawings. This paper showed an extreme variation of length, due to humidity and temperature changes, from 0.012 in. per foot of length more than the standard to 0.017 in. per foot less than the length determined as normal. This variation is less than that observed for the best tracing cloth, which varies in length under different atmospheric conditions from 0.02 in. less to 0.04 in. more per foot of length than the standard.

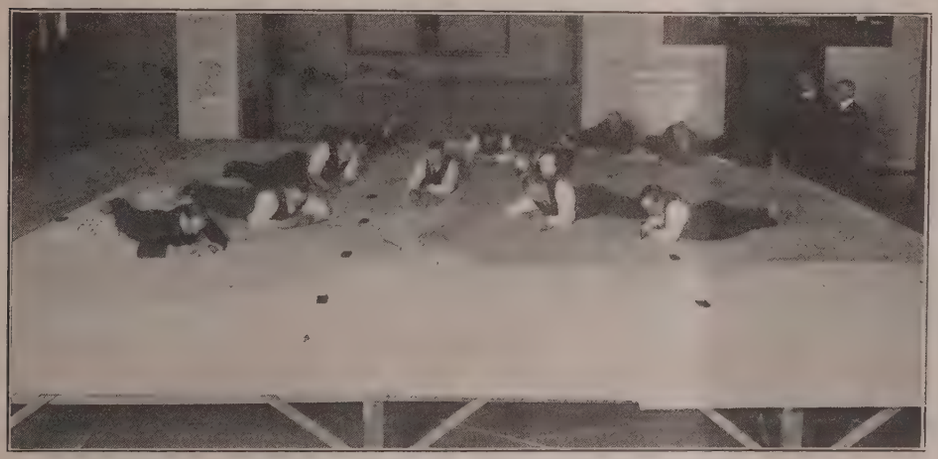
In order to trace parts of the map from sheets already made, illuminated tables with glass tops 34 x 46 in., each lighted with three 100-watt Mazda lamps, were used. This powerful illumination made it possible to trace through two thicknesses of heavy paper with results equal to those obtained in making ordinary tracings. All necessary erasures were made with a circular eraser driven by a small electric motor. This device was very much more rapid than hand erasing, and left a surface which could not be distinguished by the



THE APPARENT DARKENING OF LARGE AREAS RESULTS FROM SHADING THE PROPERTY LINES ON STREETS OFFICIALLY LOCATED BY THE CITY

eye from the original surface of the paper. For assembling the sheets in order to join them properly so that the lithographic reductions would make a perfectly fitted map, a 27 x 28-ft. platform was built, and finished like the top of a huge drafting table. A margin of one-half inch was left all around the edge of each sheet. These margins were finished by draftsmen lying on their stomachs after the twenty-one sheets had been carefully assembled and matched. This matching was helped by the fact that each sheet was divided into even minutes of latitude and longitude, the lines being deeply graved into the paper to avoid possibility of erasure. The graduation of each sheet was made from a template of the same paper, insuring that changes due to temperature and humidity would be identical for the entire series of sheets.

The 167 triangulation stations within the city limits and the twelve stations outside the city



DRAWING IN EDGES OF THE TWENTY-ONE SHEETS COMPOSING ORIGINAL 24-FOOT SQUARE MAP OF NEW YORK CITY

are all shown on the map in their exact location. Streets are shown to exact width, except that the width of the line bounding the street is all drawn inside the property, the exact street width being the distance between the edges of the lines next the street. To insure uniformity of street widths a special instrument was designed for making this map, which permitted drawing both sides of a street in one operation, and using exact gauges of various widths. During the early stages of the work reproduction to the desired scale from other maps used was done wholly by proportional devices. This method was gradually superseded by the use of a pantograph of precision. Finally, however, photography was found to be not only a more economical method, but, when small units of area were used, quite as accurate as either of the other two.

Force Employed

The maximum number of men employed at any one time was twenty-two, which force was divided into a day and a night shift. This greatly expedited the progress of the map and at the same time saved the purchase of unnecessary equipment. No vacations were allowed during the entire time, while the members of the permanent staff of the office, especially during the latter part of the work, voluntarily rendered overtime service to the amount of five and six hours a day.

The map as a whole has been lithographed on a scale of 2000 ft. to the inch. The lithographing is done in sections and the completed lithographed map is 8 ft. square. A mounted copy with certain features indicated in color has been sent to the Panama-Pacific Exposition as a part of the New York City exhibit.

Florida Senate Passes Highway Bill

The bill creating a State highway commission in Florida, strongly advocated by the Florida Good Roads Association, as noted in this journal, April 3, was passed by the State Senate, April 29.

Discuss Fire Protection Measures at Convention

Reports of Active Committees Adopted — State Building Code Regulations and Building Inspectors' Activities Discussed

The annual convention of the National Fire Protection Association in New York, May 11, 12 and 13, was marked by animated discussion of such broad topics as the relation of the building inspector to housing reform, uniformity in building laws, relations between State and city building codes and discretionary power of enforcing officials. Of particular interest to engineers, in addition to the broad topics already mentioned, were the reports and discussions on outside stairs, fire-resistive construction for private dwellings, the uses of wood in building construction, and automatic sprinkler installation.

One of the most significant discussions, at least for engineers, centered on the motion made by Richard L. Humphrey, of Philadelphia, in connection with the report on outside stairs by the committee on safety to life. During the explanation of the committee's proposal to require that windows within a 60-deg. cone from the top on each side of outside stairs or fire escapes should be of wire glass, Mr. Humphrey and others made the claim that the cost of so great a number of such windows would be almost as large as the cost of enclosing the whole stairway within smoke-proof partitions such as metal lath and cement. The motion was made that the committee incorporate a requirement for enclosure of outside stairs in its report, and much favorable discussion resulted. The motion was finally withdrawn, however, and a substitute that the committee give the subject further consideration and report to the executive committee was carried. The opinions expressed upon the effectiveness of projecting wing walls to protect outside stairs were nearly all adverse.

Reports on Fire-Resistive Construction and the Uses of Wood

The report of the committee on fire-resistive construction was made by its chairman, Ira H. Woolson, of New York, and in compliance with the request made at the last convention a complete set of recommendations for construction of private residences was presented, providing for three general classes giving full, partial and temporary protection, as determined by standard fire-test requirements. Places of amusement, motion-picture halls, skating rinks, etc., were also included in the report, which was accepted.

The committee on the uses of wood in building construction was only organized within the year, and in its first annual report made it clear that it neither discouraged nor encouraged the use of wood, but that a study of the proper treatment of wood to reduce the fire hazard was considered its legitimate function. The first work was to seek information on inflammability of various kinds of wood as well as methods of rendering it less combustible.

Relation of Inspection to Housing

Possibly because a conference of building commissioners and inspectors had been called for a joint session with the National Fire Protection Association on the general subject of building regulation, an animated round-table discussion of this topic resulted on Wednesday afternoon, under the leadership of Sidney J. Williams, State building inspector of Wisconsin, as chairman. The subject of the relation of building inspectors to housing reform was presented by Lawrence Vieller, of the National Housing Commission, who believed the indifference of such officials to be due to a false conception of their real duty, and that the wise inspector should take the lead in demanding improved housing conditions. Instead of conserving the building interests as heretofore he should protect the community against the greed of those interests. Certificates of occupancy should be issued by the inspector allowing restricted uses, and no change in use permitted without formal permission. V. G. Marani, of Cleveland, deplored the weakness of the civil service, the folly of political influence and periodic changes, and the impossibility of obtaining technically-trained men instead of barbers, butchers and the like for inspectors.

The subject of uniformity in building laws, and the advantages of State building codes was introduced by Ira H. Woolson, who expressed earnest opposition to the injustice resulting from the many variations in the building codes now in force, and believed State codes of general character should be enacted. Such codes might properly include provisions for at least the following subjects: (1) Fire limits; (2) limitation of heights; (3) floor area restriction; (4) floor loads; (5) specifications and allowable stresses for materials of construction; (6) minimum exit facilities; (7) enclosure of vertical openings; (8) safe chimney construction; (9) location of non-fireproof buildings; (10) limitation in use of inflammable roofs, and four other general requirements.

State Codes

These principles were generally endorsed during the discussion, which brought out the fact that Wisconsin, North Carolina and Ohio have already adopted State codes, and that Illinois and Pennsylvania are now working upon them. V. G. Marani pointed out the danger in including too great detail in the code, by encouraging incompetent engineers and architects to simply follow the given rules blindly. Professor Killam, of Boston, emphasized the waste and duplication of inspection in the present system, and outlined the rules established by the Massachusetts State Building Commission, which uses district police to enforce its rulings and specifies a minimum standard. The subject of the discretionary power of the enforcing official was discussed by the chairman and Rudolph P. Miller, of New York, who outlined the provisions in the Wisconsin Industrial Commission code and in the New York State law respectively.

Among those elected officers of the association at the final meeting, Mason R. Strong, consulting engineer, New York City, was given a three-year term as member of the executive committee.

Building Commissioners and Inspectors Have Conference in New York

A conference of building commissioners and inspectors was held May 14 in connection with and immediately following the convention of the National Fire Protection Association, in New York, with between thirty and thirty-five prominent commissioners and inspectors present. Rudolph P. Miller, of New York, was elected chairman and Sidney J. Williams, of Wisconsin, secretary.

The recent tendency toward low floor loads and the discrepancies between different codes were discussed, and it was moved by J. F. W. Price, of Toronto, that the conference endorse a law requiring a certificate of occupancy for all new buildings and a new certificate for any change in occupancy. This motion was carried unanimously. The subject of automatic sprinklers and the extent to which they should be required by law were then raised, and after many general opinions in favor of such requirements had been expressed it was moved and carried that the conference advocate the more general use of automatic sprinklers, and that they should be installed whenever the nature of the occupancy and the fire hazard of the construction required it. It was suggested that their use could be encouraged by concessions in the matter of exit requirements, but that absolute requirement might have to come through the fire department.

The use of hollow tile for outside bearing walls, as well as for interior partitions, was advocated by P. J. Carlin, superintendent of buildings, Brooklyn. The detailed requirements for thickness, absorption, manner of placing and bonding, and the necessity for preventing full horizontal air spaces through the wall were discussed, and present specifications of allowable stresses criticized as too low.

The question of enclosure of stairways was then introduced by F. A. Dies, of Pittsburgh, who advocated the enclosure of all stairways in buildings containing two families and over on the double ground of safety to life and prevention of the spread of fire. The effectiveness of metal lath and plaster, even with wire-glass doors and partitions, was considered sufficient to save life. It was stated that Cleveland requires enclosed stairs for all tenements three stories and over in height. The danger of sliding doors was noted, also the advantages of partitions across the corridors of hotels, to confine smoke and flame temporarily until the people could escape.

In closing it was moved that a permanent conference of building officials, State and city, and those affiliated with them be established to meet once a year. This motion was carried, and Rudolph P. Miller was elected permanent chairman and Sidney J. Williams, secretary. It was voted that arrangements for the next conference, to be held in the West, be left to the chairman and secretary, and that they be empowered to decide upon the qualifications of applicants for membership in the future conferences.

Friends Lament Death of Dr. Pearson in Lusitania Disaster

As was to be expected there has been much comment during the past week on the death of Dr. F. S. Pearson and on his important contributions to the advancement of those countries and sections in which he promoted and operated enterprises. One of his close associates in recent years has been Newman Erb, president of the Denver & Salt Lake Railroad, and also of the Minneapolis & St. Louis Railroad. When asked his judgment of his noted associate Mr. Erb sent the following note to the Engineering Record:

"Dr. Pearson was associated with me in the Denver & Salt Lake Railroad since its organization, and also in the Minneapolis & St. Louis Railroad. He was a man of extraordinary attainments. To rare ability in the development of the world's resources he added commercial and financial experience which placed him among the foremost of living men. The world has lost one of its greatest contributors to its work. We appreciated him for his ability, his exhaustive analysis of every problem with which we were called upon to deal, his fairness and integrity."

The Engineering Record has also received an appreciation of Dr. Pearson and his work from Howard P. Quick, designing and mechanical engineer of the Pearson Engineering Corporation, from which the following extract is taken:

"Where lesser men failed to do more than scratch at the surface, he stepped in, saw the possibilities, predicted the success of acquirement, consolidation, development and operation under American management and by American ways, won the confidence of the bankers of several countries, raised the funds, and, notwithstanding the handicap of a foreign language and great distance from the source of supplies and engineering direction, found the experts to do the things properly and succeeded in establishing at the cost of hundreds of millions of dollars, business enterprises thoroughly sound at the core, and except under war or revolutionary conditions paying propositions. * * * He was ahead of the manufacturers in all his demands, and many of the great engine, generator and motor companies owe their early development and expansion to him. In the electrification of the Boston, Brooklyn and New York street railroads he was the great dynamic force that overcame obstacles, built great power plants and electric systems of transit and set the pace and standards for the world."

News of Engineering Societies

The Engineers' Society of Pennsylvania held its monthly meeting, May 14, at which John Liston, of the General Electric Company, spoke on "The Panama Canal and Its Electrical Equipment."

The Albany Society of Civil Engineers will hold a meeting in that city, May 24, to hear G. H. Burgess, chairman of the valuation committee of the Delaware & Hudson Company, speak on the work that the Delaware & Hudson Company is doing in regard to the valuation of its properties under the Federal Act of 1913. It will also consider some action on the question of proposed amendments to the State Constitution now before the Constitutional Convention.

Personal Notes

Charles F. Pray has been appointed city engineer of Calais, Me.

J. M. Preston, formerly city engineer of Dallas, Tex., has opened an office as consulting engineer in that city.

C. J. Donaldson has been appointed county surveyor of Mountrail County, N. D., succeeding H. B. Schmidt.

E. D. Treadwell has been appointed acting city engineer of Webster Groves, Mo., to fill the vacancy caused by the resignation of R. L. Mook.

Frank A. Merrill, acting engineer maintenance of way of the Boston & Maine Railroad, at Boston, has been appointed engineer of maintenance of way.

T. D. Kilkenny, who has been associated with the firm of Haviland, Dozier & Tibbetts, consulting engineers, of San Francisco, assumed office as city engineer of Vallejo, Cal., May 1.

D. S. Hooker, formerly highway engineer in the office of the State engineer of New Mexico, has been appointed civil engineer of the Public Utilities Commission of the State of Colorado.

John W. Alvord, hydraulic and sanitary engineer of Chicago, has been retained as consulting engineer to the commission recently formed for the purpose of studying and reporting on a new sewer plan for the city of Davenport, Iowa.

Frank S. Lanagan is city engineer of Albany, N. Y. The notice that Leroy Greenalch assumed that office, May 1, which appeared in these columns, May 8, was a misprint. Mr. Greenalch has become city engineer of Rensselaer, N. Y.

H. M. Stephens, formerly superintendent for H. C. Kerbaugh, Inc., in charge of New York State Barge Canal construction and on U. S. Government breakwall construction at Oswego, N. Y., has been transferred to the Buffalo office of that company.

F. J. Anderson has been appointed city engineer of South Bend, Ind., succeeding W. S. Moore whose resignation to accept a similar office at Grand Rapids, Mich., was noted in these columns May 8.

David R. Cooper, consulting hydraulic engineer, formerly of 2 Rector St., New York City, has opened a new office at 39 Cortland St., where he will continue his practice, consisting principally in investigations and reports on stream flow and water-power developments.

James P. Brownell, of the engineering firm of Eaton & Brownell of Carthage, N. Y., will make the surveys and do the necessary engineering work in connection with a railroad, to be constructed by the Newton Falls Paper Company, from a point on the New York Central Railroad near Newton Falls into a new timber tract the company expects to open up.

Lieut.-Col. Charles L. Potter, Corps of Engineers, U. S. A., who has been in charge of the improvement of the Mississippi River from St. Paul to Minneapolis, has been ordered to succeed Lieut.-Col. Jay J. Morrow, Corps of Engineers, U. S. A., in charge of the improvement of Coquille River from Coquille City to its mouth, with headquarters at Portland, Ore. Colonel Morrow has been detailed to the Army War College.

Bertram D. Dean has opened an office in the L. C. Smith Building, Seattle, for the purpose of engaging in a general practice as consulting engineer, specializing, however, in reports, cost reduction engineering and quantity surveying. He was graduated from McGill University, Montreal, in 1898, and engaged in design and construction of steel structures in the eastern part of the United States for a period of six years, when he went to Seattle, as engineer for the Puget Sound Bridge & Dredging Company. He occupied this office eight years, during which period the company designed and constructed many large works, including dams, irrigation projects, bridges, foundations and harbor and municipal improvements. Since 1915 he had devoted his time to cost reduction, having had charge of the reorganization of the construction departments of several large eastern companies.

F. M. Billings has formed a partnership under the firm name of Billings & Johnson for the purpose of engaging in an engineering practice with offices at the Spreckels Building, San Diego, Cal. Mr. Billings was educated at the University of Arkansas and served for a time with the quartermaster's and engineering departments of the U. S. Army in the design of sewers, waterworks and fortifications at Fort Washington, Md. Following this, he engaged in railroad work and, in 1906, was connected with the U. S. Reclamation Service on the Huntley project in Montana. He resigned from the Government forces, after a few months, to become chief engineer and general superintendent for Hughes & Olsen, who were building the main canals and tunnels in connection with the project. From this work he went to Cuba, as engineer on government highway construction at Manzanillo. For the past three years he has been in Spain in general charge of the construction of large canals and dams on the Ebro Irrigation and power project of the Pearson Engineering Corporation.

Joseph W. Ellms, George P. Smith and Clifford N. Miller have become associated, under the firm name of Smith, Ellms & Miller, to practice as consulting engineers, with offices in the Union Trust Building, Cincinnati, Ohio. Mr. Ellms has been in charge of the Cincinnati filtration plant for many years and, in addition, has carried on a private practice as consulting engineer for the past two years, in partnership with S. G. Pollard. This partnership was dissolved about two months ago, as noted in these columns, March 20, owing to Mr. Pollard's departure for California on account of his health. Mr. Smith, until very recently, was chief engineer of the Cleveland, Cincinnati, Chicago & St. Louis Railroad and was lately appointed its consulting engineer, as noted in this journal March 13. Among the

works carried out under his direction as chief engineer was that of reconstructing the road following the floods of 1913. Mr. Miller was in charge of the engineering office of the Commissioners of Waterworks of Cincinnati at the time the filters of that city were constructed. He spent some time in the office of Wynkoop Kiersted, Kansas City, and, later, occupied an official engineering position in the Kansas City Water Department.

Obituary Notes

J. B. Gerker, civil engineer on the forces of the Southern Pacific Railway, died in St. Augustine, Fla., May 9.

Arthur B. Hanscom, civil engineer, of West Philadelphia, died there, May 12. He was graduated from Lehigh University in 1900 and was engaged in engineering work, principally in the South, since that time.

J. F. Deppe, senior engineer of the Mississippi River Commission, died at St. Louis, May 11. He was twenty years in the service of the commission, but served only two weeks as senior engineer, having attained that rank but a month ago on the death of Thomas Middleton, who formerly occupied the office.

John Birkinbine, consulting engineer, of Philadelphia, died in that city, May 14. He was born in Reading, Pa., in 1844, and received his professional education at the Polytechnic College of Pennsylvania. After serving in the U. S. Army in the Civil War he became assistant to his father as engineer of the Philadelphia waterworks. In the course of his career he designed and constructed important waterworks as well as hydroelectric plants and blast furnaces, and examined and reported upon mines and industries in the United States, Canada and Mexico. He was a past president of the American Society of Mechanical Engineers and of the Engineers' Club of Philadelphia and of the Franklin Institute. He served as expert on iron and manganese ores for the U. S. Geological Survey for 17 years and was chairman of the water supply commission of Pennsylvania since 1905.

Henry C. Derrick, formerly a consulting engineer of Houston, Va., died in that city, May 9. He began his professional career in 1851, and was U. S. district surveyor for Kansas and Nebraska from 1855 to 1858. From then until 1861 he was engineer at the U. S. Armory at Harpers Ferry. During the Civil War he served as captain of engineers in the Confederate Army, after which he engaged in railroad work until 1875, when he was appointed a lieutenant-colonel of engineers in the Egyptian Army. In this capacity he served as chief engineer in the Abyssinian campaign and was decorated for gallant services. Returning to the United States, he was appointed chief engineer of the Danville & New River Railroad in 1878. In 1887 he was appointed principal assistant engineer on the Roanoke & Southern and in 1888 resigned to enter private practice as a consulting engineer.

Edward H. Barnes, chief engineer of the Grand Rapids & Indiana Railway, died at Grand Rapids, May 15. His first engineering engagement was in the service of the New York, Lake Erie & Western, which he entered in 1878 on the extension of the Bradford Branch. In 1883 he was appointed principal assistant engineer of the South Pennsylvania Railroad, in charge of surveys and construction from Bedford to the west side of the Allegheny Mountains, including the Allegheny Mountain Tunnel, 5900 ft. long. In 1885 he became division engineer on the Union Pacific, in charge of the Colorado Division, and, in 1887, principal assistant engineer of the Baltimore & Drum Point on surveys and construction. He opened an office in New York City in 1891 for the purpose of engaging in private practice as consulting engineer. In this capacity he had charge of preliminary surveys for a tunnel line under Forty-second Street, extending west to New Jersey and east to Long Island. He also had charge of surveys for the New York Connecting Railway from Bay Ridge to a connection with the New York, New Haven & Hartford at a point north of the Harlem River. In 1895 he was appointed engineer maintenance of way of the Pennsylvania Lines West of Pittsburgh, which office he occupied until 1897 when he became resident engineer on the Grand Rapids & Indiana. He was appointed chief engineer of this road in 1906.

Civil Service Examinations

Illinois.—The State Civil Service Commission announces that examinations will be held in the near future for positions, listed below, open to residents of Illinois. These examinations will be unassembled; that is, questions on education and experience will be mailed direct to each applicant, who will write out his replies and return them to the commission.

ASSISTANT CHIEF UTILITIES ENGINEER, salary from $300 to $375 a month. Applicant must be 25 years of age and should have an education equivalent to graduation in a technical course of an engineering college of recognized standing, and experience in the design, construction or operation of public utility properties, or in connection with rate cases.

RAILROAD ENGINEER, salary $250 to $333.33 a month. Applicant must be 25 years of age, and should have high-school education, or its equivalent, and experience in either the construction or the operating department, besides familiarity with the design and maintenance of interlocking and block-signal devices.

SERVICE ENGINEER, salary $200 to $300 a month. Applicant must be 25 years of age, and should have an engineering college education, or its equivalent, and experience or ability in the operation, construction or design of utility properties and their equipment. Familiarity with Illinois Public Utilities Commission law is also essential. The duties involve directing the service inspection of utility properties and preparing orders in such cases.

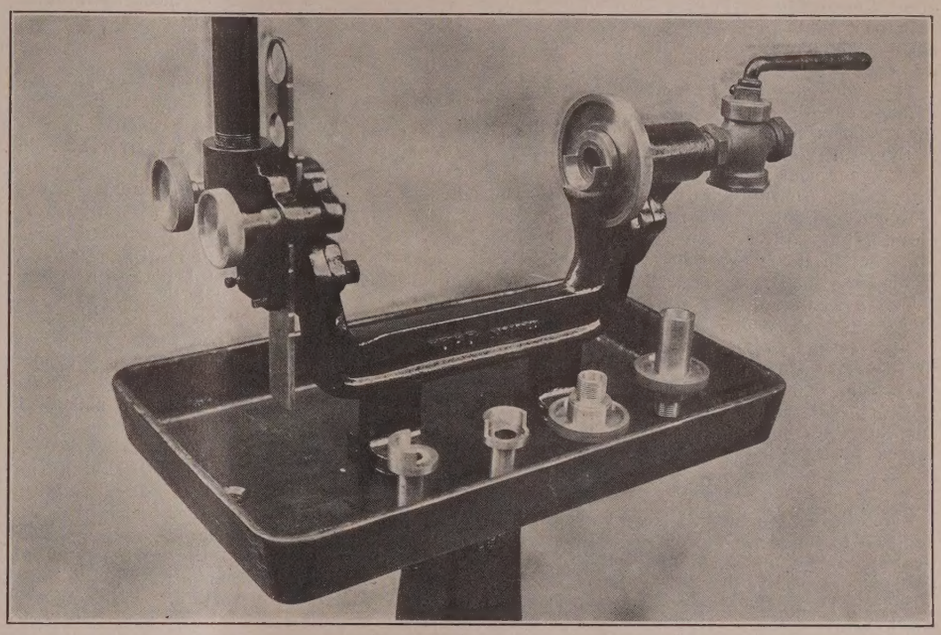
Application blanks for the foregoing may be secured by addressing the State Civil Service Commission at Springfield, or at 130 North Fifth Avenue, Chicago.

Examinations Previously Announced

Date	See Eng. Record
June 3—Transitman, Philadelphia, salary $900	April 24
June 4—Second assistant, salary $1000; assistant engineer, salary $4000; Philadelphia.	April 24
June 5—Assistant railroad engineer, State of Illinois	May 8

New, Light Meter-Tester Is Placed on the Market

For waterworks officials who are called upon to test meters but who do not wish to incur the expense of heavy, elaborate equipment the Ford Meter Box Company, of Wabash, Ind., has placed on the market the "baby tester," shown in the accompanying photograph. It is a light, compact apparatus adapted for testing one meter at a time with ten sizes of stream, ranging in diameter from 1/32 to 1 in. These variations in orifice are effected by a perforated brass strip which may be set to any opening. Brass adapters also are furnished to accommodate meters of different lengths. The "baby tester" weighs 125 lb. and costs $45.



LIGHT METER TESTER, SHOWING PERFORATED STRIP FOR VARYING SIZE OF STREAM AND ADAPTERS FOR DIFFERENT LENGTHS OF METER

Business Note

B. F. Affleck and Robert F. Hall were elected president and secretary respectively of the Cement Products Exhibition Company at the annual meeting held in Chicago, May 11, succeeding Edward M. Hagar and J. P. Beck. A. Y. Gowen was elected vice-president and J. U. C. McDaniel, treasurer.

Trade Publications

The following companies have recently issued trade literature:

Smith Engineering Works, Milwaukee. Catalog, 6 x 9 in., 24 pages, illustrated. Describes the Telsmith portable crushing plant for road building, of which there are shown three mounted types—the rigid-shaft breaker in three sizes up to No. 5, the jaw breaker in sizes to No. 12, and the jaw crusher in No. 7 size. A Telsmith portable screening plant is likewise described. This plant is said to be especially designed for gravel grading.

Gulf Refining Company, Pittsburgh. Booklet, 6 x 9 in., 68 pages, illustrated. Reviews briefly the oil situation during 1914 in reference to production and output in the States of Oklahoma, Texas and Louisiana, which constituted 72 per cent of the total yield of the country, exclusive of California, and contain the principal pools of this company's operations. It also reviews the 1914 production and output of Mexican oil and its importation in this country. It is noticeable that the unit price for a 42-gal. barrel of heavy oil fell during the year approximately from $1 to 40 cents, although the consumption of oil increased materially.

New Construction Activities

Although no steel orders have been cancelled and no inquiries withdrawn since the recent developments endangering the continued neutrality of the United States, the volume of new inquiries from domestic consumers of steel products fell off sharply last week. This has been more than offset, however, by increased export buying, in addition to which specifications have been several per cent heavier than last month. From these causes, both orders and shipments so far in May show an increased rate over April. The United States Steel Corporation is now scheduled at 76 per cent of its operating capacity.

The Louisville & Nashville Railroad has an inquiry out for 15,000 tons of bridge steel. Late reports compiled by the Bridge Builders & Structural Society give fabricating orders at 62.5 per cent of the capacity of all shops. This means from 94,000 to 100,000 tons. General consumption of steel products is nearly normal, but railroad consumption and large construction items are still low, although the former has improved considerably this month.

The granting of a permit for New York City's new $10,000,000 court house has raised the percentage of increase in building permits in that city since Jan. 1 over those of last year from 19.5 per cent, gained on May 5, to 39.3 per cent gained on May 12. Even without this item building permits last week exceeded those for the same week of 1914.

Buildings

Plans have been filed in New York City, in addition to those for the new court house, for two apartment houses to cost $500,000 and $350,000 respectively. It is reported from Harrison, N. J., that the plant of the Crucible Steel Company there will be enlarged at a cost of $375,000. A contract for foundation work on these buildings has already been awarded. A $107,000 school building has been contracted for at Jersey City. A theater at Seattle has been contracted for at $141,000. A $200,000 addition to a manufacturing plant has been contracted for at Harrisburg, Pa. Bids are desired on a $200,000 school at Rochester, N. Y., on a $300,000 high school at Erie, Pa., on a 250-room hotel at Charleston, S. C., on a $150,000 school at Atlantic City, N. J., and on a $125,000 hospital at Pittsburgh. A number of other good-sized building projects are reported, including a $600,000 appropriation for a school at Potsdam, N. Y., and a $1,000,000 traction terminal being planned at Columbus, Ohio. It is reported that a $250,000 hotel will be built at Rochester, N. Y. The bill appropriating $200,000 for enlarging the Long Island State Hospital has been signed by the Governor of New York. Plans are being prepared for a $100,000 school building at Crosby, Minn., for a $275,000 court house at Portland, Ind., and for a $140,000 school building at Lebanon, Pa.

Bridges and Roads

A contract for two small bridges has been awarded at Leavenworth, Kan. Bids are desired June 1 by the Union Station Company, Chicago, for a bridge over the river at Monroe Street. Bids are desired on a 740-ft. bridge at New Gretna, N. J., and on a steel swing bridge across Bayou Lecombe in Louisiana. Bids are also desired at Stockton, Cal., for bridge work which will total $130,000. It is reported that a $250,000 bridge will be built at New Haven, Conn., and a $225,000 bridge at Petersburg, Va.

Paving and road work promises to continue active. The lowest bid opened for constructing 27 miles of road near Starkville, Miss., was $117,000. Two paving contracts have been awarded in Jersey City and contracts on the $500,000 improvement to the Newark turnpike will be let soon. Several paving contracts have been awarded at Saginaw, Mich., and a $200,000 road contract has been let at Forney, Texas., The repair contracts awarded May 18 by the New York State Highway Commission totaled $254,000, with an additional $15,000 for stone contracts. Bids on still further State highway work are desired by Connecticut, Illinois, and New York. Bids are desired for 330,000 sq. yd. of paving at Wilmington, Del. Bids are desired at Akron, Ohio, for road work to cost $88,000. Bids on 112,000 sq. yd. of asphalt road work, including grading, are desired at Tavares, Fla. Phœnix, Ariz., has sold paving bonds in the sum of $125,000, and a bond issue of $672,000 for road improvements has been voted at Hanford, Cal.

Waterworks and Sewers

The voters of Wheeling, W. Va., defeated the bond issue of $640,000 for the construction of a patented filter installation. Work can now be planned on the lines recommended by the consulting engineers employed by the city, who were directly opposed to the scheme presented to the voters by local politicians. Laurel, Md., has awarded a $70,000 contract for water mains, a filtration plant and sewers. Water and sewer mains to cost $75,000 have been contracted for at New Smyrna, Fla. The lowest bid on a reservoir at Salem, Mass., was $68,000. Montrose, Colo., has awarded a $67,000 contract for improvements to the city waterworks. Further sewer contracts totaling $145,000 have been awarded at Philadelphia. Reading, Pa., has awarded a $39,000 contract for an addition to the disposal plant and a $64,000 contract for a storm sewer. Bids are desired June 8 for a sewage-disposal plant at Beaver Falls, Pa. Bids are desired for a sewer system at Cleburne, Texas. Plans have been prepared for a sewage disposal plant at Paoli, Pa., and for sewer work which will cost $250,000 at Canton, Ohio.

Miscellaneous

The low bid opened May 18 for a section of the Culver Rapid Transit line in Brooklyn was $863,775. A $237,000 levee contract has been awarded at Helena, Ark. Bids are desired for dredging by the U. S. engineer offices at Philadelphia and at Boston. Bids are desired for furnishing 200,000 bbl. of cement at Seattle, Wash. Bids are desired for more than 1,000,000 cu. yd. of drainage excavation at Trenton, Tenn. A 4-mile section of the New York Connecting Railroad in the Borough of Queens, New York City, will be let June 7 at the Pennsylvania Railroad offices in Philadelphia. A contract for building 23 miles of railroad at West Palm Beach, Fla., has been awarded. It is reported that the Chicago, Burlington & Quincy Railroad will build 200 miles of railroad from St. Joseph to Mexico, Mo. A $3,600,000 railroad company has been incorporated at Warren, Ariz., and another company has been incorporated to build 75 miles of railroad near Longview, Texas. Surveys have been completed for a $10,000,000 irrigation project at Prosser, Wash. The bill submitting to a popular vote the $27,000,000 additional bond issue to complete the New York State Barge Canal has been signed by Governor Whitman.

Contracting News

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

WATERWORKS.

Items Arranged Geographically

Belchertown, Mass.—Jas. L. Tighe, of Holyoke, has prepared plans for water works, and estimates cost of a pumping system at $76,234; or gravity system, $36,779.

Boston, Mass.—Bids desired until May 24 by D. Frank Doherty, Supt. Supplies, for furnishing 150 tons c. i. special castings.

★**Newton, Mass.**—Contract awarded by Metropolitan Water and Sewerage Bd., Boston, May 10, for laying c. i. water pipe in Newton, to Chas. A. Kelly, Somerville, at $27,177. Unit prices in Engineering Record of May 15.

Salem, Mass.—Following are 3 lowest bids opened May 17 by P. J. Kelley, Dir. Dept. Pub. Wks., for constructing a covered concrete reservoir of 10,000,000 gals. capacity, from plans of Wm. S. Johnson, 101 Tremont St., Boston: A. G. Tomasello, 68 Gibson St., Dorchester, $68,455; Sessler Co., Montreal, Que., $71,384; Middlesex Contr. Co., Framington, Mass., $77,290. Geo. T. Ashton, City Engr.

Buffalo, N. Y.—Bids desired until May 26 by Dept. Pub. Wks. (F. G. Ward, Comr.), for c. i. pipe and special castings, brass corporation cocks and plugs, hydrants, etc.

Madrid, N. Y.—Bids desired until May 31 by Bd. Water Comrs. (E. E. Griffith, Secy.), to furnish material and construct a water works system, and for pumping the water.

Manchester, N. Y.—Citizens voted to construct water works from plans of Chas. C. Hopkins, Cutler Bldg., Rochester.

Harrison, N. J.—Bids desired by Hudson County Park Comrs., 1 Exchange Pl., Jersey City, June 1, for completion of filter plant at West Hudson Park, Harrison; also for a pumping station at the same park.

Annapolis, Md.—Geo. F. Melvin, Pres. Annapolis Water Co., recommends construction of filtration plant; cost $20,000.

★**Laurel, Md.**—Contracts reported awarded by City Council as follows: For sewers to Dobbs & Meyers, of Meridian, Miss., water mains, disposal plant and filtration plant to Thos. Hampton, of Washington, D. C. Total cost $70,000. Engr. Harry Stevens, Union Trust Bldg., Washington, D. C.

Wheeling, W. Va.—D. G. Brown, City Clk., writes that at election held May 15 question of issuing bonds for constructing filtration system was defeated.

★**Durham, N. C.**—Contract reported awarded Apr. 21 by Mayor and Bd. Aldermen for pumping station equipment to the Christian Constr. Co., Durham; cost about $35,000. Gilbert C. White, Engr., Charlotte.

Hertford, N. C.—Bids desired until June 8 by Bd. Town Comrs. (W. C. Winslow, Clk.), for $50,000 bonds as follows: Water works, $17,000; sewerage system, $13,000; electric light system, $12,000; street paving, $8,000.

East Lake, Ga.—Citizens voted May 6 to issue $30,000 bonds for public improvements including sewers, water works, paving and schools.

★**New Smyrna, Fla.**—Contract has been awarded to J. B. McCrary Co., Atlanta, Ga., for construction of water and sewer system; cost about $75,000.

Bids desired by Bd. Pub. Wks. (G. W. Brown, Chmn.), until May 26 for machinery, tower, tank and water softening plant in connection with above.

Gadsden, Ala.—There is reported to be a movement on foot to construct reservoir, but nothing will be decided for several weeks. W. W. Johnston, City Engr.

Milan, Tenn.—Citizens have voted to issue $12,000 bonds for improving the water and light plant.

★**Alliance, O.**—Contracts have been awarded by city as follows: For a 40,000-gal steel tank, to Des Moines Steel Co., of Des Moines, Ia., and for piping connections, to J. C. Devine & Co., of Alliance. Construction work is under supervision of Chester & Flemming, of Pittsburgh, Pa.

★**Bridgeport, O.**—Contract for constructing water and sewer system reported awarded to Andrew L. Nickolich, of Fairmont, W. Va.; cost about $23,000.

★**Cincinnati, O.**—Contract awarded by Bd. Pub. Service, Apr. 30, for furnishing, also cleaning c. i. pipe, special castings, etc., for water works, to National Water Main Cleaning Co. at $19,712.

East Youngstown, O.—City Council considering construction of water works to cost about $75,000. W. H. Cunningham, Mayor.

Napoleon, O.—Press reports state bids are desired by Bd. City Affairs, until June 7 for $42,000 bonds to be used for construction of proposed filtration plant. Engr., Wm. G. Clark, of Toledo.

Wellington, O.—Citizens reported to have voted May 11 to issue $35,000 bonds for water works improvements.

Zanesville, O.—Citizens voted May 11 to issue $15,000 bonds for extending water mains.

Ahmeek, Mich.—Question of constructing water works reported under consideration by Village Council.

★**Grand Rapids, Mich.**—Contracts have been awarded as follows on bids opened May 6 for constructing trunk line water mains (R. E. Harrison, Engr., Water Dept.).

★Contract No. 1, main from pumping station to Michigan St., to D. W. Boyes,

★Items marked thus give the names of parties awarded contracts.

743 Stocking Ave., as follows: 11,000 lin. ft. excav. earth in trenches, 69 cts.; 100 cu. yds. extra excav. and back fill, $2; 200 cu. yds. rock excav., $4; 11,000 lin. ft. 30-in. pipe to lay, 72 cts.; 3 30-in. valves to install, ea., $80; 1 24-in., ea., $75; 4 8-in. blow-offs, ea., $75; 30-in. connections to existing mains (lump sum), $200; 20 cu. yds. extra concrete, $6; 5 M. B. M. sheathing left in place, $25; 6600 lin. ft. relay roadways, 30 cts.; installation at pumping station (lump sum), $700; total, $20,250.

★Contract No. 2, main from Michigan St. to stand pipe, to McDermott & Cooper, 325 Widdicomb Bldg., as follows: 10,000 lin. ft. excav. earth in trenches, 60 cts.; 100 cu. yds. extra excav. and back fill, 50 cts.; 10,000 lin. ft. 24-in. pipe to lay, 55 cts.; 3 24-in. valves to install, ea., $40; 3 8-in. blow-offs, ea., $50; 300 lin. ft. 6-in. pipe, relay, 50 cts.; 150 lin. ft. 10-in., 65 cts.; 24-in. connections to existing mains (lump sum), $86; 20 cu. yds. extra concrete, $5; 5 M. B. M. sheathing left in place, $20; 6000 lin. ft. relay roadways 25 cts.; installation at stand pipe (lump sum), $250; total, $14,103.

★**Bellwood, Ill.**—Contract awarded for 6-in. water mains on Morris Ave. and St. Paul Ave., to Michael McElligott, Evanston, at $1.16 per lin. ft. Edgar A. Rossiter, Reaper Bldg., Chicago.

Chicago, Ill.—Bids desired May 28 by W. R. Moorhouse, Comr. Pub. Wks., for furnishing and delivering approximately 2265 tons c.-i. water pipe, 16 to 24 in.; also separate bids for furnishing f.o.b. cars city pipe yard, 2352 Ashland Ave., 25 36-in. gate valves.

Columbia, Ill.—Plans completed by Fuller-Coult Co., St. Louis, Mo., for water works and sewer system, including disposal plant; cost $12,671. E. H. Brucker, City Clk.

McLean, Ill.—City Council considering question of installing water works.

Janesville, Wis.—The Mayor and Council have authorized the Bd. of Pub. Wks. to lay a 6-in. water main on Wisconsin St. from S. 3d St. to Oakland Ave.

Kenosha, Wis.—Bids desired June 14 by Bd. Water Comrs. for furnishing material and constructing a 42-in. c.-i. intake pipe about 10,000 ft. in length, a submerged intake crib and a concrete intake well, advertised in Engineering Record. B. C. Brennan, City Engr.

Cresco, Ia.—Bids desired until June 1 by M. J. McArthur, City Clk., for constructing a 100,000 gal. steel tank on a 100 ft. steel tower, building foundations, etc., advertised in Engineering Record. H. H. Howe, Engr., Cresco.

Denison, Ia.—E. F. Tucker, City Clk., writes bids desired May 24 for purchase of $20,000 bonds, to be used for construction of water works.

Oelwein, Ia.—Bids reported desired until June 7 by E. H. Burlingham, City Clk., for furnishing supplies for ensuing year to consist of 4 and 6-in. c. i. specials, etc.

Spillville, Ia.—Bids reported desired until June 5 by City Clk., for water works to include 5420 ft. 6 and 4 in. mains, 30,000 gal. tank or 60,000 gal. concrete reservoir. Des Moines Bridge & Iron Wks., Des Moines.

Garnett, Kan.—Bids desired until May 25 by F. S. Mitchell, City Clk., for furnishing and installing a 100-kw. direct connected steam generating unit, a 150-hp. return tubular boiler and a 500-gal. per min. motor-driven centrifugal pump. Worley & Black, Engrs., Reliance Bldg., Kansas City, Mo.

Solomon, Kan.—It is proposed to construct water works to cost $30,000. Election for bonds not yet held. Engineers, Harper & Stiles, Kansas City, Mo. G. M. Spalding, City Clk.

Canova, S. D.—Citizens voted May 11 to isse bonds for constructing water works. H. H. Schulte, Town Clk.

Ipswich, S. D.—Bids reported desired June 3 by L. C. Fix, City Aud., for concrete reservoir and pipe connections. Engineers, Dakota Eng., Co., Mitchell, S. D.

Judith Gap, Mont.—Town Council reported to have engaged Gerharz & Jacqueth, Great Falls, to prepare plans for water works, to cost about $20,000.

Phillipsburg, Mont.—Question of constructing water works reported again under consideration; cost about $24,000. C. H. Green, Engr., Spokane, Wash.

Gallatin, Mo.—Bonds in the sum of $17,000 reported voted, proceeds to be used for extensions and improvements to the electric lighting plant and water works.

Rockport, Mo.—Bids desired by City Clerk about June 10 for constructing water works, to cost $12,000. Engineers, W. B. Rollins & Co., Midland Bldg., Kansas City.

★**Ashdown, Ark.**—Contract has been awarded May 6 by Water Works Dist. (J. M. Johnson, Secy.) for furnishing material and constructing water works, to include 37,760 ft. mains, pump house, reservoirs, 50,000-gal. tank and tower, hydrants, valves, etc., to C. W. Cardwell, of Texarkana, at $13,233. Engineers, Winters & Dove, of Ft. Smith.

Bromide, Okla.—Board of Trustees have retained Benham Eng. Co., Oklahoma City, to make investigations, prepare estimates, plans and specifications for waterworks and electric light plant. Election will be called for after engineers report has been made. Probable cost $15,000.

Montrose, Colo. — Bids were opened May 6 for improvements to city water works, from plans of Burns & McDonnell, of Kansas City, Mo., as follows:

★Extensions and improvements—Four lowest bids: J. R. Sutherlin & Co., Kansas City, Mo., $67,320 (awarded contract); B. W. & W. T. Vedder, Grand Junction, Colo., $69,642; J. A. Pringle, Topeka, Kan., $69,682; O'Neil Constr. Co., Leavenworth, Kan., $71,630.

Unit prices of successful bidder, J. R. Sutherlin & Co.:

	Pipe to haul and lay:	
22,600	lin. ft. 4-in. c.-i. pipe.....	$0.15
10,150	lin. ft. 6-in. c.-i. pipe.....	.17
2,220	lin. ft. 8-in. c.-i. pipe.....	.20
1,595	lin. ft. 10-in. c.-i. pipe.....	.22
22,600	lin. ft. 4-in. Matheson joint	.11
10,150	lin. ft. 6-in. Matheson joint	.11
2,220	lin. ft. 8-in. Matheson joint	.15
1,595	lin. ft. 10-in. Matheson joint	.18
22,600	lin. ft. 4-in. steel pipe, pat. coup.	.10
10,150	lin. ft. 6-in. steel pipe, pat. coup.	.12
2,220	lin. ft. 8-in. steel pipe, pat. coup.	.14
1,595	lin. ft. 10-in. steel pipe, pat. coup.	.17
645	lin. ft. 8-in. c.-i. pipe.....	.20
7,025	lin. ft. 10-in. c.-i. pipe.....	.22
13,520	lin. ft. 12-in. c.-i. pipe.....	.24
645	lin. ft. 8-in. Matheson joint	.15
7,025	lin. ft. 10-in. Matheson joint	.18
13,520	lin. ft. 12-in. Matheson joint	.20
645	lin. ft. 8-in. steel pipe, pat. coup.	.14
7,025	lin. ft. 10-in. steel pipe, pat. coup.	.17
13,520	lin. ft. 12-in. steel pipe, pat. coup.	.20
....	lin. ft. 10-in. c.-i. pipe.....	.32
3,250	lin. ft. 12-in. c.-i. pipe.....	.42
....	lin. ft. 10-in. Matheson joint	.30
3,250	lin. ft. 12-in. Matheson joint	.36
....	lin. ft. 10-in. steel pipe, pat. coup.	.28
3,250	lin. ft. 12-in. steel pipe, pat. coup.	.32
18	hydrants, haul. and set.....	5.00
4	hydrants, reset.	15.00
29	4-in. gate valves, haul and set.	3.00
15	6-in. gate valves, haul and set.	3.00
7	8-in. gate valves, haul and set.	3.00
2	10-in. gate valves, haul and set.	3.00
3	12-in. gate valves, haul and set.	3.00
5	cu. yds. plain concrete.....	7.50
Cerro Summit, settling basin.....3,300.00		
Little Reservoir, improvements....3,750.00		

★Cast-iron water pipe awarded to American Cast Iron Pipe Co. as follows: C.-i. pipe, 4-in., Class B, $36.25 per ton; 6, 8, 10 and 12-in., Class B, $34.25 per ton; 8, 10, 12 and 14-in., Class A, $35.25 per ton; special castings, per lb., 2.9 cts.; total $22,124. Next 3 lowest bids: Colorado Fuel & Iron Co., Denver, $23,128; Hartman Bros., Montrose, $23,439; J. M. O. Fallon Supply Co., Denver, $23,439.

★Hydrants and valves awarded to Hendrie & Bolthoff, Denver, Colo.

★Steel pipe awarded to Hendrie & Bolthoff, Denver, as follows: 22,600 ft. 4-in. steel pipe, $26.69; 10,150 ft. 6-in., $43.89; 2865 ft. 8-in., $64,70; 8620 ft. 10-in., $86.27; 16,770 ft. 12-in., $111.95; special castings as per list, $140.

★**Riverside, Wash.**—Contract reported awarded by City Council for constructing water works to C. A. Cochran, of Spokane, at $8,152 (bids opened May 4).

Seattle, Wash.—City Council has adopted a resolution for laying water mains in Bradner Pl. from Holgate to Massachusetts St.; cost $10,000.

Following are reported to be bids opened by Bd. of Pub. Wks. for furnishing 1,000,000 ft. staves for use on city water pipe line (per 1000 ft.): (a) deliver at Noble, (b) Renton, (c) Sandstrum, (d) Seattle: Pacific Coast Pipe Co., Seattle (a) $23.10, (b) $22.38, (c) $23.43, (d) $22; Wood & Iverson, Seattle (lowest bidder), (c) $21.60; Balcom Mill Co., Seattle (a) $22.25, (b) $21.75, (c) $22.55, (d) $21.55; Washington Cedar & Fir Products Co., Seattle (a, b and d) $22.50, (c) $23.

Tacoma, Wash. — Chas. E. Peterson 3107-N 26th St., has petitioned County Comrs. for a 20-yr. franchise to lay, maintain and operate water pipes and conduits in Northeast Tacoma, and Osborne's First Addition, Tacoma, and construct a water supply.

La Grande, Ore.—It is reported that capacity of reservoir of the local water system is to be improved, by construction of a 4½ ft. concrete rim around entire basin.

Reedsport, Ore.—J. G. Kelly, Portland, reported to be preparing plans for water works.

Umatilla, Ore.—It is reported that city is to accept proposal of the Oregon-Washington Railroad & Navigation Co. to drill 15-in. well for water and to deliver same to city, the city to install a distributing pipe system, requiring about 11,000 lin. ft. of pipe. E. E. Starcher, Mayor; H. B. Hull, City Clk.

★**Escondido, Cal.**—Contract awarded by City Council May 5 for 2 pumping plants for municipal water works, to Western Gas Engine Co., of Los Angeles, at $8,958.

San Diego, Cal.—Bids desired until May 26 (extension of date from May 15) at the Bureau Yards and Docks, Navy Dept., Washington, D. C. (H. R. Stanford, Ch.), for sewer and water systems at Naval Radio Station, San Diego, according to Spec. 2151.

Reno, Nev.—City Council reported considering the question of issuing $750,000 bonds for installation of a municipal electric light plant and water works.

Twin Falls, Idaho. — Reported City Council will take immediate steps to construct water works.

★**Sugar City, Idaho.**—Contract reported awarded by Council for installation of water works to Carlson & Thompson, of Sugar City, to include a 2-mile pipe line and a 40,000-gal. steel tank and tower. Cost reported to be about $15,000.

Peterboro, Ont.—Bids desired until May 31 by S. R. Armstrong, Secy., Peterboro Utilities Comn., for furnishing and installing in place a complete pumping unit. Wm. Kennedy, Jr., Engr., 364 University St., Montreal, Que.

Stratford, Ont.—City is planning to erect a water tower at pumping station, and the matter is in hands of Hydro-Electric Power Comn., of Ontario, Continental Life Bldg., Toronto. W. H. Fretheway, City Secy.-Treas.

Toronto, Ont.—Bids desired May 25 by T. L. Church (Mayor), Chm. Bd. Control, for 5,000,000 gal pump, driven by 3-phase induction motor for Riverdale Pumping Station No. 54, advertised in Engineering Record.

Wallaceburg, Ont.—Bids desired June 1 by H. E. Johnson, Town Clk., for following works: Contract A-1, laying water mains; A-2, laying sewers; "O," laying sewer force mains; "P," constructing sewage pumping stations; "T," electric transmission line. Chipman & Power, Engrs., Mail Bldg., Toronto.

SEWERAGE AND SEWAGE DISPOSAL.

Items Arranged Geographically

★**Lexington, Mass.**—Contract reported awarded to W. B. Bryne, West Medford, for 6½ miles of pipe sewers, manholes, etc., at about $45,000.

New Britain, Conn.—Bd. of Pub. Wks. reported to be considering extension of Lawlor St. sewer to Allen St.; cost $19,000.

★**Brooklyn, N. Y.**—Contract awarded to Norton & Gorman Contr. Co., 303 Douglas St., Brooklyn, for constructing sewers in 84th St., from Stillwell Ave. to 24th Ave., at $125,931, and for sewers in 84th St., from 24th Ave. to a point east of 24th Ave., etc., at $109,993.

Huntington, L. I., N. Y.—Following are reported to be 4 lowest bids opened May 14 by Comrs. Sewer Dist. (C. M. Felt, Secy.) for constructing sewers and sewage disposal works from plans of Geo. W. Fuller, 170 Bway., New York: Fred E. Gross & Son, 726 Palisades Ave., New York, $78,300; Frank Nordone, Mt. Vernon, N. Y., $80,733; Peter Dernato, 74 Sumner Ave., Newark, N. J., $88,000; H. W. Golden & Son, 756 Jacobs St., Troy, $88,884.

Long Island City, L. I., N. Y.—Bids desired until May 24 by Maurice E. Connolly, Boro. Pres., to construct sewers and appurtenances in Polk and Val Alst Aves. and Ridge St. Total security $22,000.

New York, N. Y.—Bids desired until June 1 by Douglas Mathewson, Boro. Pres., for constructing sewers in portions of Bryant and Newton Aves. and Stearns St.

Oswego, N. Y.—Bids desired until June 1 by Dept. Works (Chas. W. Linsley, Comr.) for sewer construction, advertised in Engineering Record.

Rochester, N. Y.—City Council has adopted first ordinances providing for sewers as follows: Graves St. tunnel sewer, $12,000; Rosalind St. sewer, $4,800; also final ordinance for sewer, etc., on Congress Ave.; cost $8,000.

Point Pleasant, N. J.—Borough Council reported to have decided to spend $16,000 for new sewers.

Summit, N. J.—The question of improving sewer system including storage tank and auxiliary pump, to cost $20,000, under consideration. Nothing definite yet done. Engr., Alex. Potter, New York. Alex. Blair, City Engr.

Beaver Falls, Pa.—Bids desired until June 8 by City Council for constructing a sewage disposal plant and appurtenances, advertised in Engineering Record. Leo Hudson, Engr., 1210 House Bldg., Pittsburgh, Pa.; W. W. Piper, Supt. Pub. Improv.

East Boro, Pa.—Bids desired until May 24 by J. N. Leet, Boro. Secy., to construct a sewage disposal plant, including Imhoff tank, filtration beds and all appurtenances. C. C. Hill, Boro. Engr.

★**Greenville, Pa.**—Contract has been awarded by Boro. Council for laterals, terminal and intercepting sewers, 8 to 24-in., and disposal works, to Lesher, Roess & Lesher, Oil City, at about $43,000. The work is under supervision of Chester & Flemming, Engrs., Pittsburgh.

Johnstown, Pa.—At the recent city election, the proposition to issue $1,100,000 bonds for the construction of a sanitary sewer system and disposal plant was defeated. Plans for this system were approved by State Bd. of Health. Lee Masterton, City Engr.

Paoli, Pa.—Plans have been prepared by Herbert W. Hatton, Equitable Bldg., Wilmington, Del., for a sewage disposal plant to be constructed at Paoli for the Pennsylvania R.R. Co., and contract will be let by C. B. Temple, of Philadelphia, Asst. Ch. Engr. Pennsylvania R.R. Co., as soon as plans are approved by State Dept. of Health.

★**Philadelphia, Pa.**—Contract awarded May 10 by Dept. Pub. Wks., for extension to sewers as follows: Main sewer extension Adams Ave., Robt. Higgin, $23,000; in Fairhill St. and Olney Ave., Philadelphia Paving & Constr. Co., $18,300; Rock Run sewer in 7th St. to Frank Mark Constr. Co., $28,000; Rock Run sewer in Ashdale St. to Jos. Lombardi, $23,000; Vanango St. to Emilio Casouzzi, $23,000, and Winghocking sewer in Annsbury St. to Peoples Bros., $15,000. For repairs to Thompson St. Sewer to Keystone State Constr. Co., for installation of inlets, manholes, wellholes, laterals and sewer spurs in different parts of city, to J. Jos. McHugh, and Fred T. Buckius, at $15,000 each.

Reading, Pa.—Bids opened Apr. 30 for sewer work as follows:

★Addition to Disposal Plant. One acre Sprinkler & Final Settling Basin awarded to Peter L. Scholl, Reading, at $39,564. Next 3 lowest bids, Fehr & O'Rourke, Reading, $40,110; Cantrell Construction Co., Philadelphia, Pa., $44,300; L. H. Focht & Son, Reading, Pa., $44,998.

For 2600 ft. 60 in. Concrete Storm Sewer in Rock Tunnel: Awarded to ★Cantrell Constr. Co., Philadelphia, Pa., at $64,632. Other bids: Fehr & O'Rourke, Reading, $68,363; Jas. Ferry & Sons, Baltimore, Md., $69,810; Union Paving Co., Schenectady, N. Y., $82,698.

Washington, D. C. — Following are bids opened May 12, for constructing sewers in Dist. of Columbia (bidders all of Washington): Warren F. Brenzier Co., $18,621; Wm. F. Cush, $20,815; The J. R. Beall Constr. Co., $23,298; Geo. Hyman, $23,630. Work includes 2200 lin. ft. trunk sewer 6 ft. 9 in. to 6 ft. 3 in. diameter. Asa E. Phillips, Supt. Sewer Dept.

★**Baltimore, Md.**—Contract reported awarded by Bd. of Awards May 12, to M. O. Herron & Son, to build Stony Run trunk sewer in North Baltimore at $20,418.

Betterton, Md.—Kastenhuber & Anderson, of Easton, preparing plans for complete system of sanitary and storm water sewers with disposal plant.

Laurel, Md.—See "Water Works."

Hertford, N. C.—See "Waterworks."

East Lake, Ga.—See "Water Works."

New Smyrna, Fla.—See "Water Works."

★**West Palm Beach, Fla.**—Contract awarded to Jonas & Garrettson, of West Palm Beach, for sewer extensions (bids opened May 7) from plans of J. B. McCrary Co., of Atlanta, Ga.: 21,335 lin. ft. 8, 10 and 12-in. pipe sewers, 30 cts. to 70 cts. per ft.; 43 monholes, $20 to $60 ea.; 19 flushtanks, ea., $50; Y-branches, 60 cts. to $1; 5 lampholes, ea., $2, etc.; total, $10,341. Next 3 lowest bids: G. W. Brown, $13,072; W. A. Dutch, $13,154; Evert P. Maule, $13,869. Engineers, J. B. McCrary Co., Atlanta, Ga.

Cleveland, Tenn.—City Comrs. have passed on final reading a $60,000 bond issue for sewers.

Bexley, O.—Bids desired until May 28 by Chester A. Miller, Village Clk., for constructing sanitary sewers in portions of Park View, Drexel and Columbia Aves., and Town St. Jennings, Lawrence & Lindsay, Engrs., Hartman Bldg., Columbus.

Bridgeport, O.—See "Water Works."

Canton, O.—Estimates which will provide sanitary drainage for the northeast section and for storm water drainage in many sections, including elimination of Shriver's Run, from Walnut Ave. to the creek, has been submitted to Council. Total estimated cost, according to report of W. F. Sarver, City Engr., is $214,596, of which $103,462 will be for construction of sanitary trunk sewer extending from old disposal plant into the northeast end. The remaining sum, $111,134, will be expended for storm water drainage.

Cleveland, O.—Bids desired until May 27 by A. R. Callow, Comr. Purchases and Supplies, to construct sewers in Sandusky and Luke Aves. and Superior Rd.

Findlay, O.—Jos. Page, Clk. Bd. Pub. Service, writes that sewer bonds in the sum of $25,000 have been sold, and bids for construction of about 2500 ft. of 6 ft. brick sewer will be received the latter part of May. H. A. Glathart, City Engr.

★**Chicago, Ill.**—Contract awarded May 7 by Union Station Company, Chicago (Thos. Rodd, Ch. Engr.), for constructing trunk sewers in Canal, Clinton and Monroe Sts., concrete retaining walls and curb wall in Canal St. and curb walls in Monroe St., to the W. S. Newman Co., of Chicago.

★Items marked thus give the names of parties awarded contracts.

Green Bay, Wis.—Bids reported desired May 27 by L. Findeisen, Chmn. Com. on Sewers, for constructing 12, 24, 30, 36 and 42 in. sewers.

Wausau, Wis.—Bids reported desired May 27 by City Clerk for 4650 ft. 36, 30, 24, 20 and 15 in vitr.-pipe sewers in Wausau and Garfield Aves. and Franklin St. B. C. Gowen, City Engr.

West Allis, Wis.—Bids reported desired June 1 by Bd. Pub. Wks. for sewers, including 1000 ft. 42 in. concrete segment block.

Valley Falls, Kan.—Following are 4 lowest bids opened May 11 for constructing sewer system and sewage disposal plant from plans of Worley & Black, Reliance Bldg., Kansas City, Mo.: Squire Electric & Constr. Co., Kansas City, Mo., $38,186; Saunders & Gessmer, Kansas City, Mo., $38,856; McGuire & Stanton, Leavenworth, Kan., $39,268; Inter Mountain Bridge & Constr. Co., Tecumseh, Neb., $40,742.

Maplewood, Mo.—Bids desired until June 9 by M. F. O'Brien, City Clk., for constructing about 5000 lin. ft. 7-ft. tunnel public sewer at a cost of about $50,000.

★**Ashdown, Ark.**—Contract awarded by Sewer Dist. (J. M. Johnson, Secy.) for constructing sewer system of 40,000 ft. 8 to 15-in. vitr. pipe and sewage disposal plant to C. W. Cardwell, of Texarkana, at $29,210. Engineers, Winters & Dove, of Ft. Smith.

Cleburne, Tex.—Bids desired until June 4 by Chas. Wilhite, City Secy., for furnishing material and constructing a sanitary sewer system, including a sewage disposal plant. Burns & McDonnell, Engrs., Scarritt Bldg., Kansas City, Mo.

Chehalis, Wash.—It is reported that City Engineer Whaley estimates cost of Prindle St. trunk sewer at $25,367, exclusive of connecting with old system; a 22-in. pipe specified.

Vancouver, Wash.—City Council reported to have passed a resolution providing for construction of an 8-in. sewer on Columbia St.

Walla Walla, Wash.—W. R. Rehorn, City Engr., reported to have completed plans for about 7400 ft. 15 to 6 in. pipe sewers.

★**Palo Alto, Cal.**—Contract for 12,450 ft. 4, 6, 8 and 10-in. pipe has been awarded to California Pottery Co., San Francisco. City will lay same. Frank Kasson, City Clk.

Wallaceburg, Ont.—See "Water Works."

BRIDGES.

Items Arranged Geographically

Concord, N. H.—The Mayor and Aldermen voted to issue $86,000 bonds for constructing Main St. and Pembroke Bridges.

Woonsocket, R. I.—City Council has passed ordinances appropriating $20,000 for replacing wooden bridge over Blackstone River on Fairmount St., with a reinforced concrete structure; $60,000 for building 2 concrete bridges at lower end of Hamlet Ave., at Hamlet village.

Hartford, Conn.—Plans have been prepared by City Engineer for Park Bd. for concrete bridge with stone facings over Park River at Trumbull St. entrance to Bushnell Park.

New Haven, Conn. — Construction of a bridge over Quinnipiac River at Belle Dock is contemplated by City, at cost of about $250,000.

Waterbury, Conn.—Bids desired until June 1 by Bd. Pub. Wks., for constructing a 3-span reinforced concrete arch bridge across Naugatuck River at Bank St.; also taking down present steel truss bridge over Naugatuck River at Bank St., and its re-erection on abutments to be provided by city across said river at Freight St. R. A. Cairns, City Engr.

★**Syracuse, N. Y.**—Contract for constructing bridge over Onondaga Creek at Spencer St. awarded to Hookway Constr. Co., at $11,400.

Walkill, N. Y.—Bids desired until May 29 by J. Grant Upright, Town Supt. Highways, to furnish material and construct a concrete steel arch bridge over Walkill River, Village of Walkill. Concrete Steel Eng. Co., Engrs., Park Row Bldg., New York City.

Jersey City, N. J.—Bids desired by Hudson County Boulevard Comrs. until June 2 for cleaning and painting bridge over Newark and New York Railroad Cut, Jersey City.

New Gretna, N. J.—Bids desired June 9 by Boards Chosen Freeholders, Counties of Atlantic and Burlington, at G. A. Hall, New York Ave., Atlantic City, for building a 742 ft. bascule draw span bridge over Mullica River at Chestnut Neck, near New Gretna, also same time and place for repairs to substructure of Mullica River Bridge at Chestnut Neck, near New Gretna, both proposals advertised in Engineering Record. A. H. Nelson, Engr., Atlantic County, Atlantic City, and Jas. Logan, Engr., Burlington County, Mount Holly.

Greensburg, Pa.—Bids reported desired until June 4 by John S. Sell, Co. Controller, for structural steel bridge over Big Sewickley Creek, 100-ft. span, 20-ft roadway.

Harrisburg, Pa.—Bids desired until June 4 by County Controller, for constructing a reinforced concrete earth filled arch bridge over Wiconisco Creek at Lykens and an iron truss bridge with creosoted block floor over Armstrong Creek, about 5 miles from Halifax.

Indiana, Pa.—Bids reported desired until May 26 by County Comrs., for constructing 3 reinforced concrete bridges, 60 ft., 32 ft. and 25 ft. span respectively. John Bennett, Co. Controller.

★**Reading, Pa.**—Contract awarded May 14 for constructing concrete bridge over Schuylkill River to Whitaker & Diehl, of Harrisburg, at $17,447. Next 3 lowest bids: Reading Contr. Co., Reading, $17,500; Rennel Contr. Co., $17,587; L. H. Focht & Co., Reading, $18,998. D. K. Hoch, Co. Controller.

Bids desired until May 27 by D. K. Hoch, County Controller, Reading, for constructing a reinforced concrete girder bridge in Greenwich Township, over Saucony Creek, known as Greenwich Bridge.

Baltimore, Md.—Bids desired until May 26 by Bd. of Awards, care of City Register, for reconstructing old Chase St. Bridge on Bentalou St. over Western Maryland R. R. H. K. McCay, City Engr.

Georgetown, Del.—Bids reported desired until June 1 by Morgan T. Gun, Co. Road Engr., to to construct bridge over Marshy Hope Creek. Probable cost, $5,000.

Christiansburg, Va.—Bids reported desired until May 25 by County Comrs., to construct a steel bridge 80 ft. long over Toms Creek; also about 2291 cu. yds. approach fills. G. P. Coleman, State Highway Comr., Richmond.

Petersburg, Va.—A steel and concrete bridge is to be constructed at Second St. to connect Petersburg with Chesterfield County; cost about $225,000. The city, Chesterfield County, Norfolk & Western R.R. Co. to share cost.

Marlinton, W. Va.—S. L. Brown, Clk. County Comrs., writes bids are desired May 25 for constructing reinforced concrete bridge over Greenbrier River at Marlinton. This bridge is to take the place of a wooden bridge. Length to be 304 ft. (4 spans), 18 ft. roadway and 6 ft. walkway. There are to be two other small bridges let at the same time and place, about 55 to 60 ft. long, width of roadway 14 ft., to be either steel or concrete. Bidders to furnish their own plans.

New Martinsville, W. Va.—Bids desired by S. Myers, Co. Clk., until May 28 for constructing bridge 1 mile below Smithfield, to be concrete arch on concrete foundation, 1-span, 36 ft. long; cost $2,000.

Rome, Ga.—Bids desired until June 16 by Comrs. Roads and Revenues (J. D. Pollock, Chmn.) for tearing down and rebuilding bridges as follows: Broad St. across Etowah River; 5th Ave. across Oostanaula River; 2d Ave. across Etowah River. (Bids were opened May 21 for constructing superstructures of said bridges.)

Lake Charles, La.—Plans and specifications on file at office of Engineering Record, 239 W. 39th St., New York, N. Y., for the reinforced concrete arch bridge to be constructed over Calcasieu River near Lake Charles, bids for which are to be opened June 1 by Highway Dept., Lake Charles (F. H. Frankland, Bridge Engr.), as advertised in Engineering Record.

Louisiana.—Bids desired until June 7 by State Highway Dept., New Orleans (Frank M. Kerr, Ch. Engr.), for constructing a steel swing bridge across Bayou Lecombe, near town of Lacombe, St. Tammany Parish.

New Orleans, La.—Bids desired until May 25 at o ce of Dept. of Pub. Finances (A. G. Ricks, Comr.), for constructing a single track open deck plate girder bridge across Florida Walk Canal at intersection of Convent Ave.

Ashland, O.—Bids desired until June 14 by County Comrs. (D. F. Hay, Chmn.), for furnishing material and constructing bridges as follows: Hamilton Bridge, Ruggles Township, 60 ft. solid riveted truss, 14 ft. roadway; Iceman Bridge, Montgomery Township, 80-ft. solid riveted trust, 16-ft. roadway; Semple Ditch Bridge, Montgomery Township, 50-ft. solid riveted truss, 16-ft. roadway; Joe Sheets Bridge, Montgomery Township, 80 ft. solid riveted truss, 16 ft. roadway; John Snyder Bridge, Mohican Township, 40 ft. solid riveted truss, 16 ft. roadway; also repairs to abutments, Ed. Wiley Bridge, Orange Township, and Farquharson Ditch Bridge, Clearcreek Township.

Bucyrus, O.—Bids desired until May 31 by H. A. Biebighauser, Co. Aud., for $28,000 bonds, issued for the purpose of constructing 3 bridges, all of which are across the Sandusky River, one in Dallas Township, one in Liberty Township and one on Miller Rd., being an extension of Mary St. Bridge, City of Bucyrus.

Fremont, O.—Lowest bid opened for constructing Tindal bridge over Sandusky River, submitted by Croghan Constr. Co., Fremont, at $14,800.

Hamilton, O.—Bids desired until June 9 by W. W. Crawford, Co. Aud., for constructing steel bridge over Miami River at intersection of Wood and Chestnut Sts. Bids also desired on steel and concrete construction. F. M. Hammerlee, Co. Surveyor.

★**Struthers, O.**—Contract awarded May 10 by Co. Comrs. for constructing concrete bridge over Yellow Creek to Harvey & Watson, of Pittsburgh, Pa., at $4,351. F. H. Vogan, Comrs. Clk.

★Contracts awarded by Youngstown Sheet & Tube Co. for constructing bridges to extend from coke works to blast furnaces across Mahoning River as follows: To Clintock-Marshall Co., Pittsburgh, for a railroad bridge requiring 600 tons structural steel, to be 3 spans, each 130 ft. long, and to Pittsburgh Bridge & Iron Co. for foot bridge.

Youngstown, O.—Bids desired until May 25 by Director Pub. Service (H. C. Fox, Clk.), for furnishing material and constructing a steel bridge across Mahoning River, Milton Township, to be known as Palmyra Rd. Bridge.

Zanesville, O.—Bids desired until June 7 by County Comrs. (F. C. Werner, Clk.), for constructing steel superstructure of canal tow-path between Trimway and Adams Mills, Cass Township. Said bridge shall consist of a single span, 55 ft. from c. to c., 12 ft. clear roadway; also constructing a steel and trestle approach from Duncan Falls Bridge to Locktenders building, Harrison Township. Said trestle approach to be constructed of steel and concrete and shall consist of a span 120 ft. and shall have a 10-ft. clear roadway.

Grand Haven, Mich.—Bids reported desired until May 28 by Bd. Co. Road Comrs., Grand Haven (Jacob Glerum, Clk.) for 5 85-ft. pony trusses, 16-ft. roadway and a movable truss, 70-ft. clear waterway, 2 reinforced concrete abutments, 5 plain concrete piers, to be constructed over Grand River at Eastmanville.

Chicago, Ill.—Bids desired June 1 by Union Station Co. (Thos. Rodd, Ch. Engr.), 521 W. Adams St., for constructing a trunnion bascule bridge over south branch of Chicago River at W. Monroe St., including substructure and superstructure and installation of electrical equipment advertised in Engineering Record.

★**Illinois.**—Contract awarded by State Highway Dept. Springfield, for bridges as follows:

★Whiteside County, Nickerson bridge in Jordan Township, to J. B. Ford, Geneva, at $2,078.

★Winnebago County, Allen bridge, Owen Township, to Donald B. Ferguson, at $1,741.

De Pere, Wis.—Bids reported desired until May 29 by E. W. Janssen, City Clk., for repairing Main St. Bridge over Fox River. The work includes repairing and painting the steel, repairing creosoted roadway and sidewalk. Probable cost, $21,000. H. R. Alberts, Engr., Green Bay.

Montezuma, Ia.—Bids desired until June 7 by W. C. McKee, Co. Aud., for constructing 9 steel bridges, one concrete slab and 15 reinforced concrete culverts. C. E. Olson, Co. Engr.

★**Oskaloosa, Ia.**—Contract for constructing steel and concrete bridges in Mahaska County awarded by Bd. Supervs. to H. E. Whitlach, Beacon, and W. F. Orr, Lacey; probable cost $25,000.

West Union, Ia.—Bids reported desired May 27 by County Auditor for constructing 9 bridges, including one of three 60-ft. arches.

★**Leavenworth, Kan.**—Contract awarded May 11 for constructing 2 concrete bridges to Leavenworth Bridge Co., of Leavenworth, at $25,500. Other bidders: Missouri Valley Bridge Co., Leavenworth, $28,417; B. C. S. Coon Co., Kansas City, Mo., $28,159. H. A. Perkins, City Engr.

Butte, Neb.—Official reports state bids desired until May 25, County Bd. Superv. (J. M. Johnson, Chmn.) to furnish material and construct 2 40-ft. concrete arch bridges across Ponca Creek, one on main road between Bristow and Spencer and one on Fairfax Rd. Bids will also be received for a 50-ft. panel low truss bridge, concrete floors and piers at each of the above places.

Butte, Neb.—Bids reported desired until May 25 by S. A. Richardson, Co. Clk., to construct a number of concrete bridges.

★**Butte, Mont.**—Contract for constructing concrete bridges and 2 tunnels on Butte Division of Great Northern R.R. awarded to Widell Co., Mankato, Minn.

★**Houston, Tex.** — Contract for constructing concrete bridge over Harris Bayou on Main St. Boule. awarded by City Council to Eureka Constr. Co. at $13,000.

St. Jo, Tex.—Bids reported desired until June 7 by City Council, to construct a 50-ft. steel or concrete bridge on Williams St. across Elm Creek.

★**Watonga, Okla.**—Contract awarded by County Comrs., to Oregonia Bridge Co., Oklahoma City, for constructing steel bridge, known as Loy Bridge, at Watonga.

Bellingham, Wash.—Bids reported desired until May 29 by County Comrs. (D. Wallace, Clk.), for constructing a steel bridge across Deer Creek on Northwest Diagonal Rd., Sect. 27. Probable cost, $11,000.

★**Olympia, Wash.**—Contract awarded by County Comrs. for constructing three 80-ft. spans on concrete piers, pile foundation, low arc truss, to Coast Bridge Co., Portland, Ore. (bids opened Apr. 26).

Seattle, Wash.—Bids reported desired until June 8 by County Comrs. (Byron Phelps, Clk.) for constructing Landsburg Bridge, a 90-ft. steel span with concrete piers. Probable cost, $10,000.

★**Tacoma, Wash.**—Contract awarded by County Comrs. for constructing South Prairie bridge (bids opened May 8), to Omaha Structural Steel Wks., 605 Bankers Trust Bldg., Tacoma, at $2,998 to include concrete floors. W. R. Scott, Co. Clk.

Walla Walla, Wash.—It is reported that City Comrs. will receive bids after May 25 for construction of a reinforced concrete bridge at 2d st., to be 72½ ft. long and 48 ft. wide; cost $2,000 to $3,000. W. R. Rehorn, City Engr.

Washington. — The State Highway Comn. at Olympia will soon let contracts for constructing bridges as follows (W. R. Roy, State Highway Comr.):

Pierce County—Concrete cantilever over Mashall River, on hardpan foundation; cost $13,000.

Lewis County—Steel cantilever bridge over Cowlitz River at Mayfield; length 468 ft.; estimated cost $30,000.

Sacramento, Cal.—The House passed bill providing for appropriation of $100,000 for constructing State Highway from El Centro in Imperial Valley to the State Line.

Stockton, Cal.—Bids reported desired until June 8 by County Bd. Superv., to construct old and Middle River bridges. The work includes 2 260-ft. draw spans, 2 130-ft. and 3 95-ft. approach spans, with concrete pile or cylinder piers. Probable cost $130,000. F. E. Quail, Co. Surveyor.

Woburn, Ont.—Contract is about to be let by Scarboro Township Council for rebuilding Stott's bridge over Ruge River, to be concrete and cost $22,000.

PAVING AND ROADS.

Items Arranged Geographically

Bangor, Me.—Lowest bids opened by Bd. Street Engrs. and Com. on Streets and Highways submitted by John Grady & Son, Bangor, for macadamizing Main St., $33,558, and for wood block on Central St., $33,558.

Boston, Mass.—Bids desired by Patk. O'Hearn, Acting Comr. Pub. Wks., Boston, until May 24 for furnishing and laying asphalt or bitulithic pavement in Perth St., Dorchester.

Mayor Curley is said to favor a $500,000 loan order for new street paving in the downtown section.

The Mayor has authorized bids received for paving with wood blocks on Tremont Summit and Boylston Sts.

Fall River, Mass.—Following bids opened by Street Dept. for laying (a) Hassam block pavement. (b) Hassam compressed concrete pavement (price given per sq. yd.): Simpson Bros. Cor., Boston, (a) $3.60, (b) $2.12; C. B. Telless, Boston, (a) $3.68, (b) $2.16.

Westfield, Mass.—About $10,000 is to be spent by city for constructing sidewalks.

Rhode Island.—Bids desired until May 26 by State Bd. Pub. Wks., Providence (John F. Richmond, Chmn.), for reconstructing 4765 ft. State Highway in the town of Warwick.

Woonsocket, R. I.—City Council has passed ordinance appropriating $46,100 for replacing the bitulithic paving on Clinton St. with granite blocks.

Connecticut.—Bids desired until June 1 by Chas. J. Bennett, State Highway Comr., Capitol, Hartford, for constructing highways in towns as follows:

Barkhamsted, about 6160 lin. ft. combination gravel and native stone macadam. Plans at Manchester's Store, Barkhamsted.

Hartland, about 8300 lin. ft. native stone macadam. Plans at house of Wilbur S. Miller, First Selectman, Hartland.

Somers, about 3198 lin. ft. stone macadam. Plans at office of R. W. Stevens, Div. Engr., Connecticut Mutual Bldg., Hartford.

Andover, about 7300 lin. ft. native stone macadam. Plans at Town Clerk's office (Sacket's store), Andover.

Albany, N. Y.—Following are lowest bids opened by State Highway Com. May 18, 55 Lancaster St., for repair of public highways by State Aid:

Repair Contract No. 690, Allegany County, 11.3 miles: Kennedy Constr. Co., Albany, $8,950; McGreevey, McGuigan & Baum Constr. Co., Elmira, $9,432; F. Harrison Higgins, Olean, $9,813; I. B. Contg. Corporation, New York, $10,043.

No. 767, Allegany County, 4 miles: Kennedy Const. Co., Albany, $11,268; McGreevey, McGuigan & Baum Constr. Co.,

★*Items marked thus give the names of parties awarded contracts.*